

JCDA

February 2006, Vol. 72, No. 1

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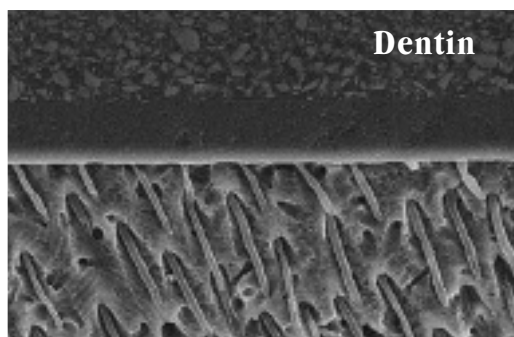
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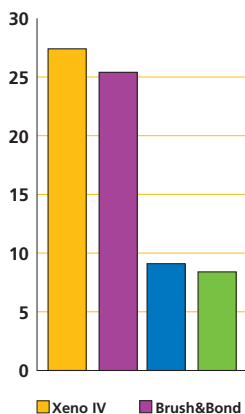


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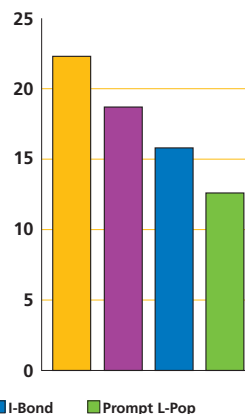


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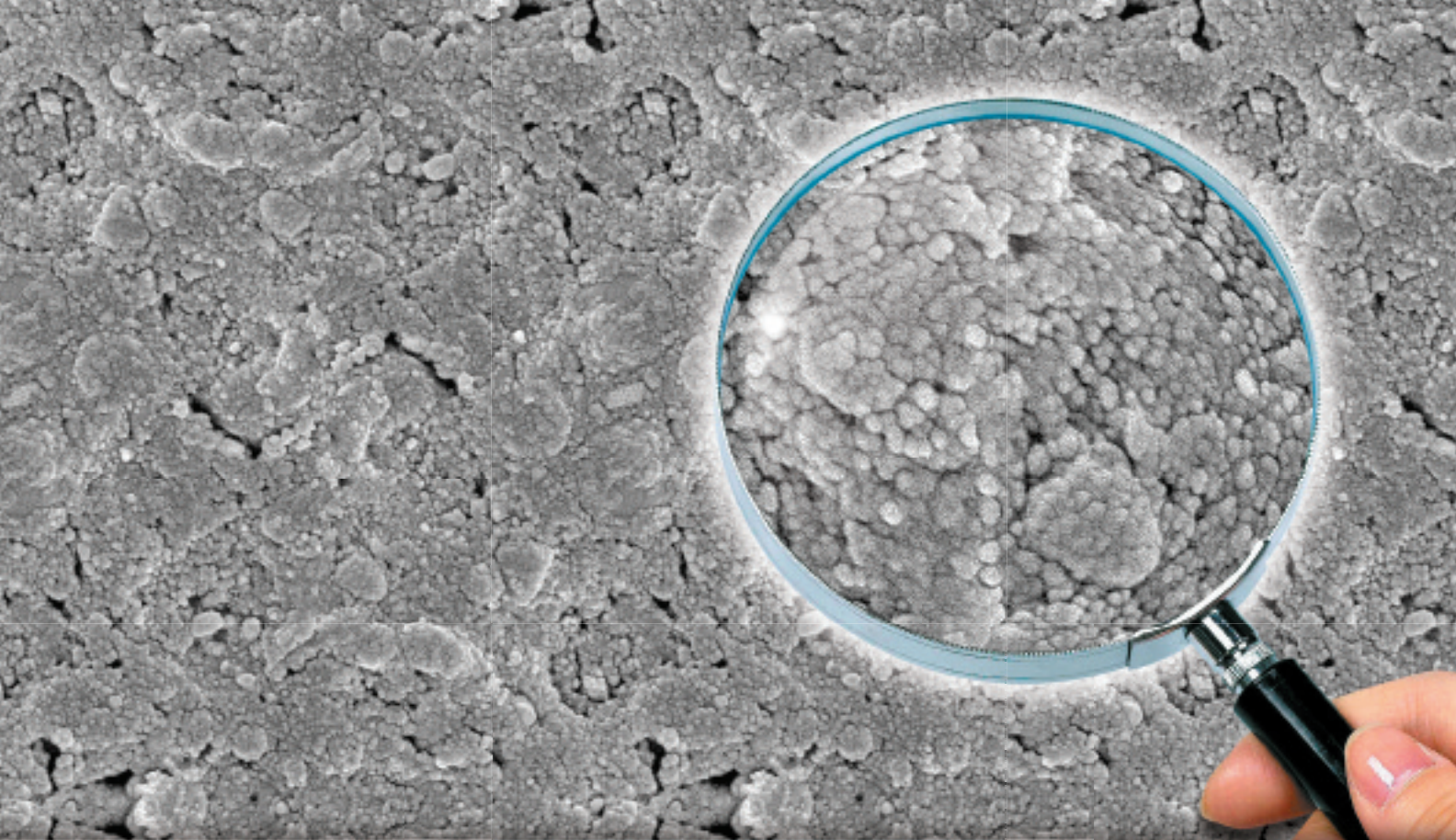
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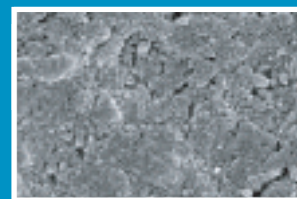
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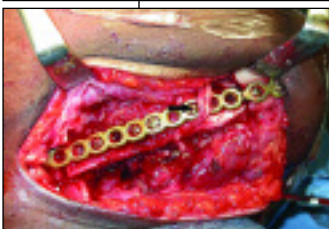
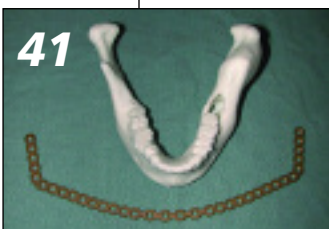
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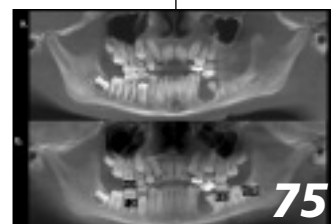
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Dr. John P. O'Keefe

Something Old, Something New

In this edition of *JCDA*, the principal authors of the "Point of Care" and "Clinical Showcase" articles are speakers at the Ontario Dental Association's Annual Spring Meeting, to be held in Toronto at the beginning of April. I am thankful to both the authors and the organizers of the event for giving us the opportunity to work together, helping to promote one of the finest events of the Canadian dental calendar.

The ODA Spring Meeting often doubles as a venue for graduates of the Ontario dental schools to come together for organized or informal class reunions. Such gatherings allow people to renew friendships and see how classmates are faring on the journey of life. I admit that I have even experienced a tinge of envy that such a spirit of community can be kept alive, especially since my own dental school class had never held such a reunion in the 25 years since my graduation.

That situation was rectified last October in Dublin, when my classmates held such an event over a weekend. Of our 41 graduates, many of whom I hadn't seen for over 20 years, 34 came together to reminisce, catch up on progress and speak about our hopes for the future. Most agreed that while we should definitely meet again, we could not allow another 25 years to lapse or a much smaller venue would suffice!

This enjoyable weekend proved to me that members of my graduating class are as fine a group of people as you could meet anywhere. Many are justly proud of the contributions they are making to advance their communities and our profession. Such professional contributions were evident as 5 classmates gave entertaining and informative presentations at a continuing education program we ran during the reunion weekend. One classmate's contribution to his community and profession was particularly impressive.

In catching up with Dr. Philip Christie of Waterford, Ireland, I discovered he had recently

published a book called *Something to chew on: a mouth map to health*. Written for the public, the book explains in easy-to-understand language how mind, body and personal motivation are key to one's health. Philip outlines how every individual can become a true partner in his or her own health care. Without a hint of paternalism, he explains how people can prevent the major oral diseases and conditions themselves and how good oral health is an essential element of good general health.

When I read the book, I found myself nodding in agreement with many of the concepts put forward. Besides the content, another aspect was intriguing. Philip mentioned that he had self-published the book, working with a Canadian company offering an "on-demand" publishing service. The more I learned, the more I was impressed by the creativity and determination displayed by my classmate.

My curiosity brought me to the website of Trafford Publishing (www.trafford.com), where I discovered more about their self-publishing process. In my opinion, a visit to this website is worthwhile, especially if you have ever harboured a desire to publish a book. The company claims to provide an innovative and unique service, having published over 8,000 titles from over 7,000 authors in 105 countries since 1995. The fact that even a print run of one copy is possible sounds pretty revolutionary to me.

The company's operating principles (accessed through a link in the 'About Trafford' section of the website) show how innovation and perseverance, combined with such seemingly old-fashioned values as courtesy and civility, can be key ingredients to success in business. These were particularly inspiring and I believe that they could serve very well as operating principles for any customer service business, including a dental office.

My reunion in Dublin reminded me that such get-togethers provide a great opportunity to learn from those with whom you share a common bond. Sometimes looking back at the road travelled can lead you to new and exciting paths in the future.

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1. Volpe AR, et al. J Clin Dent. 1996; 7 (suppl): S1-S14. 2. Data on file, Colgate-Palmolive Company. 3. Ayad f, et al. Clinical efficacy of a new tooth whitening dentifrice. J Clin Dent. 2002; 13:82-85. 4. Singh S, et al. The clinical efficacy of a new tooth whitening dentifrice formulation: A six-month study in adults. J Clin Dent. 2002; 13:86-90.

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Dr. Jack Cottrell

Defining the Value of Membership

“CDA member benefits are always reviewed and refined to ensure they meet the demands of the modern practitioner.”

During my time as CDA president I have had the privilege of attending meetings of various provincial and local dental associations across the country. These functions enable me to meet face to face with dentists and allow me to ask for their opinions on CDA's activities. These conversations overwhelmingly bring positive feedback and remind me what an honour it is to represent my fellow practitioners. However, some dentists have asked me what exactly they receive in return for their CDA membership dollar.

While this is a valid question, it does not have a simple answer. A dentist in one province may value CDA for its advocacy efforts with the federal government. Another dentist might be looking for more tangible benefits that are useful on a day-to-day basis.

When I answer this question, I try to emphasize the enormous range of services that CDA provides to members. I sometimes use the analogy that CDA supports its members with 4 pillars of service: national advocacy, representation at the global level, information and clinical support, and member benefits.

As the national, collective voice of Canadian dentists, CDA makes sure that the federal government knows dentistry's perspective on clinical and political issues, which run the gamut from access to dental care to the importance of dental research and education. Being a national association places unique demands on CDA. We often function in a coordinating or facilitating capacity, seeking consensus among provincial dental associations on matters that are important for all Canadian dentists. This cohesion is achieved by providing the appropriate forums where different dental organizations can come together to discuss issues and propose solutions.

Representing the interests of all Canadian dentists extends beyond our national borders. CDA maintains a close reciprocal relationship with the American Dental Association. Our involvement with the FDI World Dental Federation and the ISO technical committee for dentistry allows CDA to provide input into FDI position statements and to play a key role in international dental standards. While much of this global-level work takes place behind the scenes, it is crucial to the advancement of the profession in Canada.

CDA offers its members support in the form of information services and clinical practice resources. Dentists and dental office staff are made aware of the latest developments in clinical, political and practice management matters through *JCDA*, *CDAalert* e-mail bulletins, *Editors' Choice* selections and the CDA website. CDA's Resource Centre offers a range of information services that are relevant to the research or practice management needs of members. CDA also offers its support to dental academia and the dental regulatory authorities in Canada.

Finally, CDA's member benefits are always reviewed and refined to ensure they meet the demands of the modern practitioner. For instance, while CDA continues to provide support to CDAnet users on a daily basis, we are now championing the evolution of electronic dental claims transmission technology by offering the eQualifID digital certificate for ITRANS as part of CDA membership.

More recently, 2 new member services were introduced: the Lexi-Drugs and Lexi-Natural Products drug databases and the Member Savings Centre (MSC). The latter provides CDA members with online access to special discounts on many products and services from well-known suppliers like Microsoft and Grand & Toy.

This 4-pillar analogy merely scratches the surface of the wealth of activities that CDA is either involved with, organizes or administers. Whether it is providing a discount on your next purchase of office supplies or lobbying the federal government on GST legislation, CDA always works with its members' best interest at heart. CDA truly offers a level of service that is first class. So is membership in CDA strong value for your dollar? It's worth every cent.

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CAPD's Position on Formocresol

After careful review of the formocresol article written by Casas and others¹ by the scientific committee of the Canadian Academy of Pediatric Dentistry (CAPD), the CAPD executive feels compelled to write in order to help the readers of *JCDA* avoid any confusion regarding our position on the ongoing use of formocresol as a pulpotomy agent for the treatment of primary teeth in pediatric patients. In their paper, Casas and others express concern with regard to the formaldehyde component of Buckley's formocresol. To support their position, they cite an outdated rodent study² in which the relationship between exposure to formaldehyde and nasal squamous cell carcinomas was investigated. However, the concentrations of formaldehyde used in this study were over 1,000 times higher than typical environmental exposures and 8 times higher than the U.S. occupational exposure limit.

The June 15, 2004 press release of the International Agency for Research on Cancer (IARC),³ in which formaldehyde was reclassified from a "probable" to a "known" human carcinogen, has been cited by Casas and others as evidence that formaldehyde should be eliminated from pediatric dentistry. However, clarification of the IARC press release is required in case readers are left with the impression that the IARC classification is definitive and binding. The IARC classification is a hazard identification, not an assessment of risk. The classification is merely an attempt to answer the question as to whether, under any circumstances, a substance could produce cancer in humans. For example, formaldehyde falls in the

same group as x-rays (along with solar radiation and alcoholic beverages). While we may expose our patients to x-radiation and formocresol, we accept that the benefits outweigh the risks. Furthermore, the IARC reclassification was based primarily on the results of a single National Cancer Institute (NCI) study⁴ among workers in formaldehyde industries in which very small numbers with a rare cancer were identified in one plant from among several plants and many workers. Clearly, confounding variables may have affected the results and because of these uncertainties, the NCI has agreed to update the study, which is now progress.

Casas and colleagues also cite evidence that formaldehyde is distributed to distant organs after pulpotomy and infer, with no supporting evidence, that children may be at increased risk for cancers. Readers of *JCDA* must be advised that the evidence cited to support this inference is from outdated investigations shown to have been based on flawed assumptions and resulting in erroneous projections. It is now recognized that formaldehyde is a highly reactive chemical that is rapidly metabolized. New evidence has shown that radioactive labels found at distant sites are most likely attached to metabolites of formaldehyde. In fact, numerous studies using various animal models and different

methods of delivering formaldehyde suggest that there is *no* delivery of formaldehyde to distant sites. The abundance of this negative evidence, as well as the fact that formaldehyde naturally occurs throughout the body as a result of normal metabolic processes and that the body is equipped to manage this formaldehyde exposure, suggests that the development of cancers at distant sites in children is biologically implausible.^{5,6}

Casas and colleagues refer to a study by Zarzar and others,⁷ and state, incorrectly, that 10% of children in the study who received a single formocresol pulpotomy had a statistically significant increase in chromosomal aberrations. In fact, the authors report no statistically significant differences between the treated and control groups for chromosomal aberrations, chromatid breaks and chromatid gaps. Zarzar and others conclude that formocresol is not mutagenic. While chromosomal aberrations were observed in 1 patient (1 of 20, or 5%), the authors were unable to determine whether formocresol or other variables may have accounted for this finding.

In keeping with accepted therapeutic principles, the lowest dose possible of formocresol should be applied for the shortest possible time to obtain the desired effect. To that end, a 1 in 5 dilution of Buckley's formocresol should be used because it has been shown to be equivalent in effect to full strength formocresol. The dilution can easily be prepared by a pharmacy and involves mixing

Editor's Comment

JCDA welcomes letters from readers about topics that are relevant to the dental profession. The views expressed are those of the author and do not necessarily reflect the opinions or official policies of the Canadian Dental Association. *JCDA* reserves the right to edit letters for length and style. Letters should ideally be no longer than 300 words. If what you want to say can't fit into 300 words, please consider writing a piece for our Debate section.

1 part full strength formocresol with 3 parts glycerine and 1 part water.

Considering the obligation for informed consent, dentists should be telling parents about the potential risk of pulp therapy involving formocresol as well as all the other potentially dangerous agents used in dentistry such as radiation, resins, local anesthetic and antibiotics. CAPD supports continued research and diversity in pediatric dental techniques. However, until a superior agent is identified, we support, on the basis of modern scientific evidence, the judicious use of formocresol in pediatric dentistry. CAPD has submitted for publication in *JCDA* a paper by Dr. Alan Milnes that supports this position; we trust it will be published in a future edition of *JCDA*.

The executive of CAPD:

Dr. Kelly Wright

Dr. Sarah Hulland

Dr. Louis-René Charette

Dr. Paul MacDonald

Dr. Victor Legault

References

1. Casas MJ, Kenny DJ, Judd PL, Johnston DH. Do we still need formocresol in pediatric dentistry? *J Can Dent Assoc* 2005; 71(10):749–51.
2. Swenberg JA, Kerns WD, Mitchell RI, Gralla EJ, Pavkov KL. Induction of squamous cell carcinomas of the rat nasal cavity by inhalation exposure to formaldehyde vapor. *Cancer Res* 1980; 40(9):3398–402.
3. International Agency for Research on Cancer, World Health Organization. IARC classifies formaldehyde as carcinogenic to humans. Press release No. 153, June 15, 2004. Available from: URL: www.iarc.fr/ENG/Press_Releases/archives/pr153a.html.
4. Hauptmann M, Lubin JH, Stewart PA, Hayes RB, Blair A. Mortality from lymphoproliferative malignancies among workers employed in formaldehyde industries. *J Natl Cancer Inst* 2003; 95(21):1615–23.
5. Heck H, Casanova M. The implausibility of leukemia induction by formaldehyde: a critical review of the biological evidence on distant-site toxicity. *Regul Toxicol Pharmacol* 2004; 40(2):92–106.
6. Cole P, Axtan C. Formaldehyde and leukemia: an improbable causal relationship. *Regul Toxicol Pharmacol* 2004; 40(2):107–12.
7. Zarzar PA, Rosenblatt A, Takahashi CS, Takeuchi PL, Costa Junior LA. Formocresol mutagenicity following primary pulp therapy: an in vivo study. *J Dent* 2003; 31(7):479–85.

Response from the Authors

The executive of CAPD supports a different interpretation of the health risks of formaldehyde than we do. The focus of their letter is the issue of formaldehyde safety, with particular emphasis on the statement from the International Agency for Research on Cancer, which, in June 2005, reclassified formaldehyde from a probable to a known carcinogen. However, members of the executive did not challenge the evidence of equivalent clinical outcomes between formocresol and ferric sulfate pulpotomy and the superior outcomes of the latter for root canal treatment of vital primary molars.

We feel that the risks of formaldehyde exposure are, at best, uncertain. Our suggestion that prudent clinicians no longer need to use formocresol in children has been further supported by evidence of equivalence for alternative vital primary pulp techniques described in 3 papers published since our November article appeared in print.^{1–3}

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University of Toronto

References

1. Deery C. Formocresol and ferric sulfate have similar success rates in primary molar pulpotomy. In carious primary molars does a pulpotomy performed with ferric sulphate, compared with formocresol, result in greater clinical/radiographic success? *Evid Based Dent* 2005; 6(3):70.
2. Huht KC, Paschos E, Hajek-Al-Khatir N, Hollweck R, Crispin A, Hickel R, and other. Effectiveness of 4 pulpotomy techniques — randomized controlled trial. *J Dent Res* 2005; 84(12):1144–8.

3. Markovic D, Zivoinovic V, Vucetic M. Evaluation of three pulpotomy medicaments in primary teeth. *Eur J Paediatr Dent* 2005; 6(3):133–8.

Education of Family and Caregivers

The authors of the article on oral trauma in a comatose patient¹ give an informative review and an insightful example of a solution to a very real problem. As a dentist who is presently training to be a neurosurgeon, I am struck by a valuable point raised in the article: the importance of educating family and caregivers.

From personal experience, I know that despite the best intentions of the staff in critical care environments, oral medicine and hygiene are often of secondary importance to other more critical medical and surgical issues. One solution may be the inclusion of dentistry as part of the multidisciplinary health care “team” approach to patient care in the critical care environment, especially in cases of comatose adult patients.

Dr. Stephen McCluskey

Neurosurgery resident

University of Toronto

Toronto, Ontario

Reference

1. Kobayashi T, Ghanem H, Umezawa K, Mega J, Kawara M, Feine JS. Treatment of self-inflicted oral trauma in a comatose patient: a case report. *J Can Dent Assoc* 2005; 71(9):661–4.

The Manifestations of Barodontalgia

In their article on barodontalgia, Robichaud and McNally¹ describe the oral manifestations of barometric pressure changes such as dental pain, in vitro tooth fracture and deterioration of restorations. I agree with the authors that although rare, barodontalgia and vertigo of dental origin² cannot be ignored by the dental community because it is potentially life-threatening.³

It must be stated, however, that barodontalgia (*baro-* barometric,

Continued on p. 16

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Letters

Continued from p. 14

odont- dental, *algia-* pain), as it appears in the article title, refers only to the barometric-induced toothache, whereas deterioration of restorations and tooth fracture (*odontocrexsis*) usually occurs without pain. Thus, carious lesions, tooth trauma and deteriorating restorations are *not* “physical manifestations” of barodontalgia.

The authors’ statement that barosinusitis will always occur on descent, whereas barodontalgia always begins on ascent does not take into account barodontalgia caused by subclinical pulp necrosis with or without periapical pathology. This type of toothache can appear on descent as well.⁴

Dr. Yehuda Zadik
Head of the Zrifin Central Dental Clinic
Medical corps
Israel Defense Forces
Department of anatomy and cell biology
Hebrew University-Hadassah School of
Medicine
Jerusalem, Israel

References

1. Robichaud R, McNally ME. Barodontalgia as a differential diagnosis: symptoms and findings. *J Can Dent Assoc* 2005; 71(1):39–42.
2. Eidelman D. Vertigo of dental origin: case reports. *Aviat Space Environ Med* 1981; 52(2):122–4.
3. Clark JB. Risk assessment and clinical aeromedical decision-making. *Aviat Space Environ Med* 1993; 64(8):741–7.
4. Ingle JJ, Dudley HG. Differential diagnosis and treatment of dental pain. In: Ingle JJ, Bakland LK, editors. *Endodontics*. 4th ed. Baltimore: Williams and Wilkins; 1994. p. 534.

Funding Available for Systematic Reviews

Part of the mandate of the Canadian Collaboration on Clinical Practice Guidelines in Dentistry (CCCD) is to develop clinical practice guidelines (CPGs). The CPGs, developed from ‘best evidence,’ should assist dentists in clinical decision-making. The ‘best evidence’ comes from systematic reviews, which have long been considered in

medicine as primary research. Instead of being based on individual cases (human patients or experimental animals), systematic reviews are based on transparent and systematic evaluation of published reports (generally full papers and conference reports). McMaster University has been hugely influential in the development of systematic reviews and evidence-based clinical practice.

A CCCD survey of all full-time faculty in the 10 Canadian dental faculties in 2004 found that 22% of respondents would like to conduct systematic reviews. CCCD is willing to sponsor Canadian faculty who wish to do this type of research, particularly if the CPGs developed from the reviews address issues most likely to impact everyday general dental practice.

For more information, visit the CCCD website at www.cccd.ca.

Dr. David MacDonald
Canadian Collaboration on Clinical Practice
Guidelines in Dentistry

Challenging Dentists to Act

Dr. Glover’s article¹ is potent, articulate and passionate. It is one of the most significant articles to have been published in a dental journal in recent memory. As a health care provider, it stirs me to lead by deeds, not mere words.

Dr. Ali Farahani
Renfrew, Ontario

Reference

1. Glover VA. A challenge to dentists to take a leading role in the evolution of Canadian health care. *J Can Dent Assoc* 2005; 71(11):845–7.

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CDA Achievements

Here is a brief selection of CDA's significant activities and achievements of 2005. Many of these initiatives directly benefit CDA members.

FDI Congress: In August, the 93rd FDI Annual World Dental Congress came to Montreal. This global dental showcase attracted more than 14,000 registered participants, including over 4,700 dentists. CDA collaborated with the FDI World Dental Federation and the Order of Dentists of Quebec to organize the event. Dr. Burton Conrod, CDA past-president, was voted FDI president-elect, becoming the first Canadian ever to hold this position.



Member Services: Two new services exclusive to CDA members were introduced in 2005. Lexi-Drugs On-Line and Lexi-Natural Products are clinical information databases that give members access to time-sensitive prescription and over-the-counter drug information at the point of care. This product also allows dentists to produce customizable patient advisory



leaflets available in 18 languages. The Member Savings Centre (MSC) was launched in December, giving CDA



members special offers and discounts on a range of products and services from well-known suppliers, including Grand & Toy, Microsoft and HP.

Shared Concerns Conference: In March, representatives from the dental profession and the benefits industry came together to discuss common issues related to the delivery of oral health care to Canadians. Participants at the conference, which was co-sponsored by CDA, examined broad issues relating to the introduction of new treatments as well as the design and administration of dental plans.

Seniors' Conference: CDA hosted a 1-day conference in February designed to examine ways of improving access to care for senior citizens in Canada. "Taking

Action on Seniors Oral Health in Canada" was organized with input from representatives of the British Columbia, Ontario and Nova Scotia provincial dental associations.

CDA Website: CDA unveiled its redesigned website in October (www.cda-adc.ca). The revamped site has many new features and services designed to make it easier to access content and increase interactivity with dentists. The new site is divided into 4 main content areas: *Your Oral Health*, *The Canadian Dental Association*, *The Dental Profession* and *Members*. This last section includes services and resources exclusive to CDA members.



CDA Position Statements: CDA undertook a thorough review and update of its position statements on clinical and professional issues. The statements are available to the public for information purposes on CDA's website. CDA members can access additional resources, including a list of official positions from related national and international dental and health organizations.

CDA Seal of Recognition: Three new categories were added to CDA's Seal of Recognition program in 2005. Powered toothbrushes, home water filtration systems and bottled fluoridated water are now included alongside such established categories as anti-caries, hypersensitivity and tobacco cessation products.



Public Education: In April, CDA planned a range of activities for its National Oral Health Month public education campaign. With the theme *Oral Health – Good for Life*, the campaign helped promote the importance of regular oral examinations by a dentist and good oral hygiene.



CDA collaborated with the *National Post* and the *Journal de Montréal* to produce special oral health newspaper supplements. CDA also facilitated the publication of a 16-page oral health insert that appeared in the October edition of *Homemakers'* and *Madame* magazine.

JCDA: The print version of *JCDA* was given a new look and feel starting with the September edition. In keeping with a new publication strategy, the paper version of *JCDA* will strive to be “essential reading” for Canadian dentists and evolve into a community-building publication. *JCDA* continues to be circulated to all Canadian dentists and is now published 10 times per year.



Non-Insured Health Benefits (NIHB): Three major improvements to the NIHB dental program were implemented in July, directly related to a coordinated and ongoing lobby effort led by CDA. The 3 changes were: (1) removal of the \$800 threshold for basic care; (2) elimination of predetermination for endodontic therapy on anterior teeth; (3) acceptance of the Standard Dental Claim Form.

Academic Event: CDA hosted its 4th annual Academic Event in November with a theme of ensuring a sustainable future for academic dentistry in Canada. Members of the dental profession and dental academic community came together to propose innovative ways to maximize government funding channels to the ultimate benefit of Canadian dental schools.

Strategic Planning Session: CDA invited key stakeholders from the dental profession for a Strategic Planning Session in January. As part of a 5-year review process, the group examined CDA's vision, mission statement and key result areas. Based on recommendations from the session, a new mission statement was approved at the Annual General Meeting in April.

MISSION STATEMENT
CDA IS THE NATIONAL VOICE
FOR DENTISTRY, DEDICATED TO
THE ADVANCEMENT
AND LEADERSHIP
OF A UNIFIED PROFESSION
AND TO THE PROMOTION
OF OPTIMAL ORAL HEALTH,
AN ESSENTIAL COMPONENT
OF GENERAL HEALTH.

ISO/TC 106: A Canadian delegation attended the 41st meeting of the technical committee for dentistry of the International Organization for Standardization (ISO/TC 106) in Rome, Italy, in September. CDA continues to host the secretariat of ISO/TC 106, allowing Canadian dentistry to monitor dental standards at every stage of the approval process. Dr. Derek Jones, professor emeritus of biomaterials at Dalhousie University, was named chair of the committee for a 5-year term.



MEMBER SAVINGS CENTRE

CDA Launches Member Savings Centre

CDA members have exclusive access to discounts and savings through the Member Savings Centre (MSC). This new value-added member benefit allows dentists to save money and stay competitive while efficiently meeting the demands of their hectic professional and personal lives.



Members have instant access to savings on a wide range of brand name products and services. Enjoy discounts from Canada NewsWire, HP Canada, Microsoft, FTD Flowers, UPS, Grand & Toy and more. New products and suppliers will be added to the MSC program throughout 2006. Visit the Members' section of the CDA Web site and **start saving today**.

www.cda-adc.ca/en/members/practice_management/savings_centre/default.asp

Dental Coverage for Refugee Claimants

CDA was invited to participate in the inaugural meeting of the Interim Federal Health Advisory Committee (IFHAC) on November 24, 2005. This committee was formed to provide practical recommendations to the Department of Citizenship and Immigration Canada on the policies and management of the Interim Federal Health (IFH) Program.

The IFH program provides temporary, emergency or urgent health care for refugee claimants to Canada. These patients are eligible for dental coverage under the IFH program until they qualify for coverage under the appropriate provincial health plan. Among other items, the committee is examining whether the range of dental services offered to claimants should be expanded.

The dental benefits component of the IFH program is currently limited to essential or emergency services. However, as of October 2004, benefits are no longer capped at an overall maximum of \$400. Similarly, treatment can now exceed the previous 2 teeth per visit maximum, provided the case is urgent or has received prior approval.

Dentists are encouraged to learn more about the IFH program. All relevant IFH claim and predetermination forms can be printed or downloaded from the *Client Information* section of the FAS Benefit Administrators website at www.fasadmin.com. Dentists can also contact the FAS call centre for more details at 1-800-770-2998. ➤

Photodynamic Disinfection Therapy Approved by Health Canada

In November 2005, Ondine Biopharma Corporation received approval from Health Canada for its Periowave therapy system. This photodynamic disinfection system employs a nonantibiotic approach for treating the underlying infections responsible for periodontal disease.

Photodynamic therapy (PDT) is a minimally invasive, local technique that has been effective in the treatment of some cancers. It requires a light source and a photoreactive drug (photosensitizer) capable of binding or being in close proximity to the cells being targeted. Irradiation of the photosensitizer produces free oxygen radicals that have strong cytotoxic effects, destroying cell membranes and DNA.

Ondine Biopharma is headquartered in Vancouver, B.C., with research laboratories in Redmond, Washington. More details about Periowave, including initial results from a clinical trial, can be found at www.ondinebiopharma.com. ♦

Commentary

JCDA editorial consultant Debora Matthews, DDS, Dip Perio, MSc, is head of the division of periodontics at Dalhousie University in Halifax, Nova Scotia. JCDA sought Dr. Matthews' insights on this news item.

Photodynamic Therapy and Periodontitis

Periodontitis is a multifactorial disease, modified by both local and systemic risk factors. While destruction of the periodontium is a result of an overreaction of the body's inflammatory and immune systems, it will not occur in the absence of bacteria.

Mechanical removal of plaque biofilms and plaque retentive calculus is currently the most efficacious method of treatment. However, mechanical removal of plaque is technically challenging and laborious and may not completely eradicate all microbes. In certain types of periodontal diseases, systemic and local antibiotics can help overcome some of these limitations, but use of antibiotics has its own drawbacks, not the least of which is the development of bacterial resistance. In an effort to find a nonsurgical periodontal therapy that overcomes these limitations, research is being done to evaluate the efficacy of photodynamic therapy (PDT) in killing periodontal pathogens.

The discovery that certain dyes are absorbed and accumulated in cancerous tumours stimulated the clinical use of PDT. More than 400 compounds have demonstrated photosensitizing properties, including toluidine blue, which is used as a vital dye for oral mucosa. Bench-top research has shown it is effective in the eradication of several periodontal pathogens, including *P. gingivalis*, *A. actinomycetemcomitans* and *P. intermedia*.

Clinical Research

Despite the success of numerous in vitro studies, very limited clinical data exist on the efficacy of PDT in the management of periodontal diseases.¹⁻³ Such clinical data are derived exclusively from case reports and case series, which fail to use a control group to compare outcomes between the experimental and traditional therapies.

In a September 15, 2005 press release,⁴ Ondine Biopharma reported the successful completion of a randomized clinical trial using its Periowave PDT system. It appears that this clinical trial has not been published and has therefore not been submitted to critical peer review. The online summary of the trial's results does not mention what comparison group was used, how patients were randomized or if those evaluating the outcomes were blinded. These factors have the potential to seriously bias the study results.

Based on the evidence to date, treatment of periodontal diseases using PDT of any type is still considered experimental. ♦

References

1. Meisel P, Kocher T. Photodynamic therapy for periodontal diseases: state of the art. *J Photochem Photobiol B* 2005; 79(2):159-70.
2. Komerik N, Wilson M. Factors influencing the susceptibility of Gram-negative bacteria to toluidine blue O-mediated lethal photosensitization. *J Appl Microbiol* 2002; 92(4):618-23.
3. Matevski D, Weesink R, Tenenbaum HC, Ellen RP, Lepine G. Lethal photosensitization of periodontal pathogens by a red-filtered Xenon lamp in vitro. *J Periodontol Res* 2003; 38(4):428-35.
4. Ondine Biopharma reports successful pilot clinical trial results. September 15, 2005. Available from: URL: www.ondinebiopharma.com/press_releases/September_15_press_release_FINAL_DRAFT_II.doc (accessed January 10, 2006).

Edentulism Rates Drop Dramatically

A Statistics Canada health report released November 15, 2005, revealed a significant decrease in edentulism rates in Canada. In 2003, 9% of Canadians aged 15 or older reported that they had no natural teeth. This figure is down from 16% reported in a similar survey in 1990.

The largest decline in edentulism rates occurred amongst people aged 65 or older. While nearly half of this group was edentate in 1990, the numbers dropped to 30% in 2003. Similarly, in the 55 to 64 age group, a 17% decrease was seen between the 2 reporting periods.

The authors of the report, Wayne J. Millar and David Locker, speculate that the reduction in edentulism rates could be attributed to a number of factors including a greater prevalence of water fluoridation, improved access to care, increased disposable income and an increase in dental benefits.

Among the provinces, Quebec had the highest edentulism rates at 14% while the Northwest Territories had the smallest numbers at 5%. The authors hypothesized that the high number of smokers in Quebec along with a less widespread access to fluoridated water may have contributed to the province's figures.

The ability to pay for dental services continues to play a significant role in edentulism rates, as 18% of Canadians in low income households were edentate compared to just 3% in those from the highest income bracket. ♦

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New CPR Guidelines Emphasize Chest Compressions

Cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) guidelines published in 2005 place a greater emphasis on administering chest compressions during emergency situations.

The new guidelines now recommend 30 chest compressions for every 2 rescue breaths. This is a significant increase from previous guidelines where 15 compressions for every 2 rescue breaths were the standard. Co-authored by the Heart and Stroke Foundation of Canada, the new guideline document stresses that rescuers should minimize interruptions and "push hard and push fast" when performing chest compressions.

Guidelines for the use of defibrillators in similar situations have also been modified. After 1 shock from a defibrillator, rescuers should now provide approximately 2 minutes of CPR, beginning with chest compressions, before re-analyzing the heart rhythm and attempting another shock. Previously, 3 shocks could be delivered before CPR was recommended, resulting in chest compression delays of over 30 seconds.

To view the complete 2005 CPR and ECC guidelines, see the Heart and Stroke Foundation of Canada website at <http://ww2.heartandstroke.ca/Page.asp?PageID=24>. ♦

Briefs

Dental Corps Association Seeks Members

Have you served with the Canadian dental corps in some capacity? If so, you are invited to join the Royal Canadian Dental Corps Association (RCDCA), which currently brings together more than 230 members. The group consists of all ranks from the dental corps, both serving and retired. The association publishes a newsletter and meets socially on an annual basis. For more information, contact the RCDCA by email at prmcqueen@rogers.com or visit its new website at <http://rcdca.cfdental.ca/>. ♦

Cannabis-Impaired Driving Campaign Targets Youth

The Canadian Public Health Association (CPHA) launched its *Pot and Driving* campaign in 2005, designed to raise awareness among young Canadians about the risks of cannabis-impaired driving. This national campaign was developed after reviewing the current evidence and receiving input from both professional groups and Canadian youth.

According to CPHA, Canadians between the ages of 14 to 25 have one of the highest rates of cannabis use in the world. Many young Canadians who use pot feel it is a benign, mainstream drug with no significant negative consequences. Drug use surveys indicate that youth are more inclined to drive while under the influence of pot rather than alcohol.

Information on the campaign, including promotional and educational resources, can be found at www.potanddriving.cpha.ca. ♦



Poster developed for the *Pot and Driving* campaign.

Manitoba ECC Prevention Program Receives Funding

Manitoba Health announced that it would commit \$1.2 million over 2 years to expand the Healthy Smile — Happy Child Early Childhood Tooth Decay Prevention Project throughout the province. This multidisciplinary project is a collaboration between such organizations as Health Canada's First Nations and Inuit Health Branch, the Manitoba Dental Association and the University of Manitoba's Centre for Community Oral Health.

The project uses community-based promotion and activities to prevent early childhood caries in high-risk children in the province, including First Nations children. It focuses on educating young parents and future mothers about the importance of proper nutrition and dental hygiene, targeting these groups in settings where they interact with service providers. The announcement, made in November 2005, was part of Manitoba Health's overall commitment of \$1.6 million to pediatric dental care initiatives in the province. ♦



Dr. Maureen Lefebvre

Saskatchewan College Elects President

Dr. Maureen Lefebvre of Regina, Saskatchewan, was elected president of the College of Dental Surgeons of Saskatchewan effective January 1, 2006. Dr. Lefebvre received her DMD from the University of Saskatchewan in 1991. Since graduation, Dr. Lefebvre has maintained a dental practice in Regina. ♦

Cover Close-up

Dr. Peter Nkansah

The path that leads from being a talented university basketball player to becoming the official dentist for a professional basketball organization may not be conventional, but it is the road travelled by the CDA member featured on this month's *JCDA* cover.

Dr. Peter Nkansah of Toronto, Ontario, has been a member of the National Basketball Association's Toronto Raptors medical team for over 10 years. The University of Toronto graduate and former co-captain of the Varsity Blues basketball team offers his professional services to the Raptors on a voluntary basis.

Dr. Nkansah makes sure to attend every Raptors home game, making himself available before, during and after the contest. "On game days, the medical staff is responsible for the Raptors, the visiting team and their staff, and the referees," explains Dr. Nkansah. "I would say that I am called upon in about one-third of games."

Players' elbows and forearms can go astray during games, which presses Dr. Nkansah into action. "The time pressures in the NBA are intense, which means that instant turn-around is not only preferred but expected," he says. "In a business where 15 players make up the face of a high profile, multi-million dollar company, one player's absence can affect the whole team's performance."

Recalling some of his more memorable interventions, Dr. Nkansah has helped repair lacerations in the mouth for such marquee players as Allen Iverson and Chris Bosh. Re-cementing an anterior temporary post-core crown for an opposing team's head coach before one game brought a smile to both the patient and dentist.

Dr. Nkansah's primary duties as the Raptors' dentist include attending the pre-season medical examinations to assess the oral health status of the players and coaching staff. He also coordinates ongoing or urgent dental care for the players, coaches and families throughout the season.

Dr. Nkansah enjoys the camaraderie of working with a team of health professionals in one of the 5 major North American sports. He offers his assistance to the entire Raptors medical team, which means he is sometimes called upon to act outside the parameters of dentistry. "Since I have postgraduate anesthesia as well as advanced cardiac life support (ACLS) training, I can be useful for more than just teeth," he adds.

His role within the organization also gives Dr. Nkansah the opportunity to offer informal counselling to some of the young, instant millionaires who make up the ranks of the NBA teams. "Coming into large sums of money at such an early age could pose coping problems for anyone," he says. "Learning how to take care of your body and mind throughout the long season and road trips without your friends and family for support is difficult, and I try to lend an ear or offer words of non-basketball advice."

Within the dental community, Dr. Nkansah is a member of the teaching staff at the University of Toronto's faculty of dentistry and at the Regency Dental Hygiene Academy. He is the current president of the Canadian Academy of Dental Anaesthesia. As someone who sees many anxious and medically compromised patients at his private practice, Dr. Nkansah supports and defends the continuation of dentist-provided sedation/anesthesia in the profession. "I don't want to see this service taken away from patients, which is why I believe it should be granted specialty status," he emphasizes.

Outside of his practice and Raptors obligations, Dr. Nkansah enjoys spending time with his wife and young daughter. Organized camping is one activity that provides particular joy and satisfaction. "Camp Jumoke and Summer Dreams are 2 charitable organizations that I'm involved with at arm's-length," he explains. "Camp Jumoke provides a 2-week camp for children with sickle cell disease, while Summer Dreams provides financial assistance to allow underprivileged kids to attend camp." ♦



Photo courtesy of Ron Turenne, NBA Images

"SINCE I HAVE
POSTGRADUATE ANESTHESIA
AS WELL AS ADVANCED
CARDIAC LIFE SUPPORT
TRAINING, I CAN BE USEFUL
FOR MORE THAN JUST TEETH."

New NDEB Exam Format Results in Fee Reduction

Over the past 4 years, the National Dental Examining Board of Canada (NDEB) has developed and piloted a significant change to the format of the objective structured clinical examination (OSCE).

The new format primarily uses extended match questions with up to 15 possible answers. The same set of question and answer templates is used on every examination and is posted on the NDEB website.

The new OSCE was implemented completely in March 2005. Feedback and statistical analysis supported the reliability of the examination. As a result of the successful implementation and the completion of the intensive development phase, NDEB was able to reduce 2006 fees by an average of 19%. The dates, registration deadlines and fees for the 2006 NDEB examinations can be found at www.ndeb.ca. ♦

OBITUARIES

Busse, Dr. C. Dave: Dr. Busse of Swift Current, Saskatchewan, passed away on November 24. He graduated from the University of Manitoba in 1968.

Caron, Dr. Jean-Guy: A 1958 graduate of the University of Montreal, Dr. Caron of Sainte-Adèle, Quebec, passed away on October 10.

King, Dr. James M.: A 1971 graduate of the University of Toronto, Dr. King of Peterborough, Ontario, passed away in 2005.

Petrullo, Dr. Charles: Dr. Petrullo of Niagara Falls, Ontario, passed away on November 12 at the age of 81. He graduated from the University of Toronto in 1947.

Plumb, Dr. Basil M.: Dr. Plumb of Vancouver, B.C., passed away on October 20.

Stinson, Dr. Frederick L.: Dr. Stinson of Surrey, B.C., passed away in 2005. ♦

To access the websites mentioned in this section, go to February's JCDA bookmarks at www.cda-adc.ca/jcda/vol-72/issue-1/index.html.



Have you visited the CDA Members' Forum yet?

The CDA Members' Forum allows dentists across Canada to share information and discuss topics related to the dental profession *in real time*. The forum is an exclusive online service located on the members-only section of the CDA Web site.

To enter the forum:

1. Go to the CDA Web site at www.cda-adc.ca/forum.
2. Enter your username and your password in the log-in box. If you have never logged into the members-only site before, your default password is your CDA membership number as written on your membership card. For detailed instructions about usernames and passwords, click the "Help" button under the log-in box.
3. For privacy purposes, you will automatically be prompted to change your password the first time you visit the forum. Follow the instructions, then log in using your new password.*
4. Once you have entered the members-only site, you will be directed to read the forum rules and policies. Review the rules and policies, then click "Accept". You have now joined the CDA Members' Forum!

* E-mail Addresses

If CDA does not have a record of your e-mail address, you will be prompted to provide one after you log in with your new password. Follow the instructions to either provide or opt-out of providing an e-mail address. Although not mandatory, a valid e-mail address is required to access certain features of the forum, such as e-mail notification. *Member e-mail addresses will only be used for the purpose of providing online services to you.* For information regarding CDA's Privacy Policy, visit www.cda-adc.ca.

Don't know your password?

Contact CDA at 1-800-267-6354 between 8 a.m. and 4 p.m. EST or e-mail reception@cda-adc.ca.

Forgot your password?

If you have logged in to the members' side of the site before but have forgotten your password, you can retrieve it online. Go to:
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Sales Tax Scenarios

Questions continue to arise about dentists' entitlements and obligations with the goods and services tax and harmonized sales tax (GST/HST) and the Quebec sales tax (QST).

CDA enlisted the services of tax specialists KPMG LLP (KPMG) to research and draft responses to some common queries related to GST/HST and QST. The answers provided are intended for general information purposes; dentists are advised to consult with a sales tax advisor to discuss their individual circumstances.

Question 1

Are dental practices required to register with the Canada Revenue Agency (CRA) for GST/HST and, if located in Quebec, with the Quebec Ministry of Revenue (MRQ) for QST purposes?

KPMG Responds

Registration for GST/HST and QST purposes applies to legal entities only, such as a sole proprietorship, corporation or partnership. Most dental practices fall into one of these categories and, as such, may be required to register with CRA or MRQ.

In general, a dental practice is obliged to register if the total revenue generated from taxable supplies in 4 consecutive calendar quarters exceeds \$30,000. If revenues from taxable supplies are below this \$30,000 threshold, the practice would be considered a small supplier and registration is optional.

It is important to account for all types of taxable supplies when calculating the small suppliers threshold. Taxable supplies include sales, leases and rentals of property (e.g., goods, real property and intangible personal property) and services that are taxable at the general rate of tax. The general GST rate is 7%. The general HST rate in New Brunswick, Nova Scotia and Newfoundland is 15%. The general QST rate in

Quebec is 7.5%, applied on the GST-included price.

Cosmetic dental services are one example of a taxable supply. Other taxable supplies are considered "zero-rated," which means that they are taxable but at a rate of 0%. A prime example of a zero-rated supply is the provision of artificial teeth.

The vast majority of dental procedures such as examinations, radiographs and restorations are considered "exempt" supplies. In fact, if a dental practice *only* makes exempt supplies it cannot register for GST/HST and QST purposes.

A basic example helps illustrate the importance of accounting for all taxable supplies. If a dental practice had revenues of \$20,000 for cosmetic dental services (taxable at the general rate of tax), \$25,000 for artificial teeth (taxable at 0%) and \$75,000 for exempt supplies (not taxable), the total taxable sales would be \$45,000 — an amount that exceeds the \$30,000 threshold.

If your dental practice is not currently registered with CRA for GST/HST or with MRQ for QST (if your practice is located in Quebec) and you are concerned that the level of your taxable supplies exceeds the \$30,000 threshold, you should discuss your situation with a sales tax advisor.

The "Business of Dentistry" section of JCDA provides information and resources related to the business aspects of dentistry. Further practice management material is made available on the members' section of CDA's website. Send your suggestions for future "Business of Dentistry" topics to publications@cda-adc.ca.

Question 2

What is the definition of a “cosmetic dental service” for GST/HST and QST purposes?

KPMG Responds

In general, a dental service performed for cosmetic reasons, as opposed to medical or reconstructive reasons, is a taxable supply for GST/HST and QST purposes.

The GST/HST and QST legislations do not define a cosmetic service. CRA has indicated

that cosmetic dental services include services performed essentially for esthetic reasons and at the request of the patient. This can sometimes include the application of a veneer to a patient’s front teeth.

A case study is provided to illustrate if a dental procedure could be considered a taxable cosmetic service or an exempt procedure for GST/HST and QST purposes.

Case Study

A 10-year-old girl is concerned with white and brown spot lesions affecting the labial surfaces of her maxillary incisors. The diagnosis is chronological hypoplasia and the dentist proposes a direct composite veneer application after minimal enamel reduction. The primary concern is esthetic, but the dentist is restoring damage caused by systemic disease at a young age.

Possible Interpretation

The appearance of the teeth — a cosmetic concern — may have been the initial reason for the appointment. However, if the cause of the discolouration is a health condition, then the purpose of the dental service is medical, not cosmetic. Also, if the veneer has a structural purpose, this would support the judgment that the service is not cosmetic. In this case, the service performed is for medical or reconstructive purposes and therefore is considered an exempt supply for GST/HST and QST purposes.

Question 3

What is the definition of “artificial teeth” for GST/HST and QST purposes?

KPMG Responds

The supply of an artificial tooth is zero-rated for GST/HST and QST purposes. This means that the fees are taxable at a rate of 0%. Dental practices registered for GST/HST and QST may therefore recover the GST/HST and QST paid on taxable costs relating to the supply of the artificial tooth.

The GST/HST and QST legislations do not define artificial teeth. The CRA considers artificial teeth to be a manufactured good that is anatomical in nature and fabricated for use as a substitute for natural teeth.

When a manufactured good replaces 50% or more of a natural tooth, the CRA will consider the manufactured good to be an artificial tooth. The CRA understands that while dentists use terms such as crowns, caps and partial crowns, it is a question of fact whether a particular good meets the requirement of replacing 50% or more of a natural tooth.

As most dental practitioners realize, it can be problematic to determine when 50% or more of a natural tooth is replaced. Similarly, a crown may be considered zero-rated or exempt depending on the percentage of the natural tooth that is replaced. Two case studies are provided to illustrate the definition of artificial teeth for GST/HST and QST purposes.

Case Study 1

A 50-year-old patient has 2 unsightly porcelain-fused-to-metal crowns on teeth 11 and 21 that were placed almost 20 years earlier. Tooth 11 has been root filled and receives a cast gold post. Less than 50% of the coronal tooth structure remains. Tooth 21 is vital, and after removal of the existing crown, more than 50% of the coronal tooth structure remains. Each procedure is itemized separately on the invoice.

Possible Interpretation

In this example, CRA may consider this as 2 separate supplies. The first (tooth 11) would be the supply of a zero-rated artificial tooth because more than 50% of the tooth structure was replaced. The second (tooth 21) would be an exempt supply because 50% or more of the tooth was not replaced.

Case Study 2

A 35-year-old patient had orthodontic work performed during his teenage years and presents with unsightly teeth 12, 11, 21 and 22. Tooth 12 is peg-shaped and has failing direct bonded composite build-up. Tooth 11 had previously received root canal therapy, is discoloured and has a large composite restoration. Tooth 21 has only a small composite restoration, but there has been a little orthodontic relapse and the tooth is now very slightly retroclined. Tooth 22 is pristine, but as is common where the contralateral tooth is peg-shaped, this tooth is slightly small.

Overall, there is a size discrepancy between the central and the lateral teeth. The dentist proposes Empress Crowns for teeth 12 and 11 and Empress Veneers for teeth 21 and 22. There is an orthodontic concern for teeth 21 and 22. Would the treatment of these teeth be considered an exempt supply, a supply of artificial teeth (zero-rated) or a cosmetic service (taxable at the standard rate).

Possible Interpretation

In this example, the fees relating to teeth 11 and 12 would be zero-rated as artificial teeth if the Empress Crowns replace 50% or more of the natural teeth and the crowns are charged for separately. Although the services relating to teeth 21 and 22 are for appearance purposes, the service is also for medical or reconstructive purposes, and therefore exempt from GST/HST and QST.

KPMG's responses are based on the GST/HST and QST legislations, the published administrative policies and guidelines of the CRA and the MRQ and any relevant jurisprudence as of December 1, 2005. Changes to any of the foregoing could impact the information provided.

KPMG also assisted CDA in preparing a comprehensive GST/HST and QST Manual and a condensed GST Pocket Book reference guide. These 2 publications are freely available to CDA members through the CDA website. Readers are encouraged to consult these publications for further explanation, examples and calculations. These guides can be found at www.cda-adc.ca/en/members/practice_management/gst_hst/manual.asp.

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Before

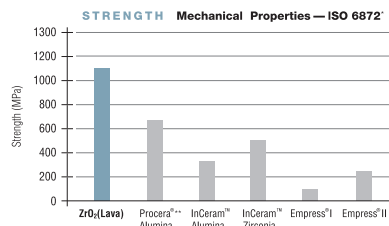


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The "Point of Care" section answers everyday clinical questions by providing practical information that aims to be useful at the point of patient care. The responses reflect the opinions of the contributors and do not purport to set forth standards of care or clinical practice guidelines. This month's responses were provided by speakers at the Ontario Dental Association Annual Spring Meeting (www.oda.on.ca), which will be held April 6–8 in Toronto, Ontario.



QUESTION 1

Does tooth bleaching have any adverse effects on enamel and dentin?

Background to the Problem

Tooth bleaching methods generally involve the application of 10% (or higher concentration) carbamide peroxide (CP) or hydrogen peroxide (HP) products to the tooth surface for several hours daily over a few weeks in an at-home regimen and the application of 30% (or higher) HP to the tooth surface for several minutes during a few sessions in an in-office regimen. These regimens can be repeated many times to maintain tooth whitening. A wide range of bleaching products is currently available. In Canada, these products are classified as cosmetics, and there is therefore no specific requirement that their safety and effectiveness be proven. It is important to determine the potential adverse effects of these widely used products, particularly when used repeatedly.

Tooth bleaching treatments have been associated with certain negative effects on dental hard tissues. With regard to enamel and dentin, the research has examined primarily the effects of bleach on bonding of adhesives, surface hardness and surface morphology. Few studies have focused on how bleaching products affect the structural integrity of the dentin.

Effect of Tooth Bleach on Bonding of Adhesives to Enamel and Dentin

Applications of CP and HP in simulated at-home and in-office tooth bleaching protocols drastically reduced the strength of bonding when adhesives were applied to enamel and dentin.^{1–3} The reduction in bond strength is explained by residual HP that remains after the cessation of bleaching, which inhibits polymerization. The reduction in bond strength is reversible, and bond strength increases after 1 week. Therefore, adhesive bonding to enamel and dentin should be delayed until 1 week after a bleaching treatment.

Effect of Tooth Bleach on Enamel and Dentin Surface Morphology and Hardness

Changes to enamel and dentin surface morphology have been described in several studies.^{4–8} A decrease in enamel surface hardness has also been reported.^{9,10} The significance of these changes is questionable, however, since they affect only the outer few micrometres of enamel and may be reversed after exposure to saliva.

Effect of Tooth Bleach on the Structural Integrity of Dentin

Bonding and hardness studies reflect changes to the surface only and do not characterize changes to dentin beyond the surface layers. The structural integrity of the teeth is better determined by strength and fracture toughness studies.

In a recently published study, direct exposure to 10% and 15% CP caused a significant decrease in the flexural strength and flexural modulus of elasticity of bovine teeth.¹¹ This effect appeared to be time related, and there was a greater decrease in mechanical properties after a 2-month period than after a 2-week period of daily bleach application and no difference when the shorter (1 hour daily) application times of HP were used. Chng and others¹² reported significant decreases in the ultimate tensile and micropunch shear strengths of dentin after intracoronal application of 30% HP. In both these studies, the bleach was applied directly to the dentin surface. These studies characterized the structural changes that occur as a result of direct application of bleach to dentin and are relevant to clinical cases of bleaching in which there is dentin exposure, such as occlusal attrition or gingival recession. However, the intended clinical application of bleach is onto enamel, not dentin.

Our laboratory has just investigated the effect of indirect applications (i.e., through intact enamel) of CP and HP on the fracture toughness of dentin.¹³ The in vitro fracture resistance of dentin

was significantly reduced by 17% after daily indirect application of 10% CP for 8 weeks, and by 17% and 37% after daily indirect application of 16% CP for 2 and 8 weeks, respectively. Direct application of the same bleach products to dentin significantly decreased dentin fracture toughness even more. Time (2 vs. 8 weeks) and application mode (direct vs. indirect) were significant factors.

Until the specific cause of reduced dentin structural integrity as a result of bleaching is determined, measures to prevent dentin weakening or to aid in the recovery of dentin fracture resistance after bleaching will remain unknown. Topical fluoride treatment and storage of specimens in artificial saliva for 2 weeks after application of bleach or control material did not affect the flexural strength and modulus.¹⁴

The studies on strength and fracture toughness suggest that caution should be exercised when bleach is applied directly on dentin (e.g., in occlusal attrition or root recession) for prolonged treatment times. ➤

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Dr. Tam's half-day session at the ODA annual meeting, titled "The facts about tooth whitening", will be presented on Thursday, April 6.

References

1. Titley KC, Torneck CD, Smith DC, Adibfar A. Adhesion of composite resin to bleached and unbleached bovine enamel. *J Dent Res* 1988; 67(12):1523-8.
2. Torneck CD, Titley KC, Smith DC, Adibfar A. Adhesion of light-cured composite resin to bleached and unbleached bovine dentin. *Endod Dent Traumatol* 1990; 6(3):97-103.
3. Titley KC, Torneck CD, Ruse ND. The effect of a carbamide-peroxide gel on the shear bond strength of a microfill resin to bovine enamel. *J Dent Res* 1992; 71(1):20-4.
4. Shannon H, Spencer P, Gross D, Tira D. Characterization of enamel exposed to 10% carbamide peroxide bleaching agents. *Quintessence Int* 1993; 24(1):39-44.
5. Bitter NC. A scanning electron microscope study of the long-term effect of bleaching agents on the enamel surface in vivo. *Gen Dent* 1998; 46(1):84-8.
6. Bitter NC, Sanders JL. The effect of four bleaching agents on the enamel surface: a scanning electron microscopic study. *Quintessence Int* 1993; 24:817-24.
7. Ernst CP, Marroquin BB, Willershausen-Zonnchen B. Effects of hydrogen peroxide-containing bleaching agents on the morphology of human enamel. *Quintessence Int* 1996; 27(1):53-6.
8. Josey AL, Meyers IA, Romaniuk K, Symons AL. The effect of a vital bleaching technique on enamel surface morphology and the bonding of composite resin to enamel. *J Oral Rehabil* 1996; 23(4):244-50.
9. Basting RT, Rodrigues AL Jr, Serra MC. The effects of seven carbamide peroxide bleaching agents on enamel microhardness over time. *J Am Dent Assoc* 2003; 134(10):1335-42.
10. de Freitas PM, Basting RT, Rodrigues JA, Serra MC. Effects of two 10% peroxide carbamide bleaching agents on dentin microhardness at different time intervals. *Quintessence Int* 2002; 33(5):370-5.
11. Tam LE, Lim M, Khanna S. Effect of direct peroxide bleach application to bovine dentin on flexural strength and modulus in vitro. *J Dent* 2005; 33(6):451-8.
12. Chng HK, Palamara JEA, Messer HH. Effect of hydrogen peroxide and sodium perborate on biomechanical properties of human dentin. *J Endod* 2002; 28(2):62-7.
13. Noroozi A, Kuo V, Tam LE. Direct and indirect peroxide bleaching on fracture toughness of dentin. *J Dent Res*. Forthcoming 2006.
14. Tam LE, Abdool R, El-Badrawy W. Flexural strength and modulus properties of carbamide peroxide-treated bovine dentin. *J Esthet Restor Dent* 2005; 17:359-68.

QUESTION 2

What is the best way to use epinephrine in a medical emergency?

Background to the Issue

Other than oxygen, epinephrine is the most versatile and important emergency drug in an emergency drug kit. It can be used in the treatment of allergy, anaphylaxis, asthma, cardiac arrest or hypotension.

In any medical emergency, time is of the essence. Injection is the fastest way to introduce a drug into the whole body. As such, injection is an invaluable route of drug administration when speed matters.

Epinephrine is a sympathomimetic agent that interacts with the α and β receptors of the sympathetic nervous system throughout the body. The effects of epinephrine include an increase in the heart rate, peripheral vasoconstriction (which increases the blood pressure) and bronchodilation.¹⁻³

Intravenous (IV) injections put epinephrine directly into the bloodstream, but if staff members in the dental office are unfamiliar with IV protocols, then intramuscular (IM) injections are the method of choice. Intralingual injection of epinephrine (on the ventral surface of the tongue) is also acceptable but should not be performed with an auto-injector.

Management of the Issue

One of the basic ingredients for successful management of medical emergencies is good preparation of the team. Team members should know that when they face a medical crisis, they should always start with the ABCs of cardiopulmonary resuscitation — airway, breathing, circulation — and then signal for help from the

rest of the team. Once the initial steps of basic emergency management have been performed, the specific problem should be diagnosed. If the situation calls for an epinephrine injection, the injection should be administered and a 9-1-1 call placed.

IM injections of epinephrine can be given in a number of ways. The EpiPen system (Dey, Napa Valley, Calif.; Fig. 1) and the new Twinject system (Verus Pharmaceuticals, Inc., San Diego, Calif.; Fig. 2) are preloaded auto-injectors. Both of these systems contain 0.3 mg of epinephrine for adults. The EpiPen Jr. and pediatric Twinject auto-injectors (for people less than 30 kg [66 lb]) contain 0.15 mg of epinephrine. The least expensive, yet most versatile, method of administering epinephrine is with a manual needle and syringe with glass ampoules of epinephrine at a concentration of 1:1000. There are 2 important points to remember about all 3 of these systems. First, none of the systems is mistake-proof when it comes to



Figure 1: EpiPen auto-injector.



Figure 2: Twinject auto-injector.



Figure 3: Administration of epinephrine into the thigh.



Figure 4: Administration of epinephrine into the shoulder.

administering the drug; second, you must become familiar with whatever system you choose *before* you have to use it.

The best places for an IM injection of epinephrine are the anterolateral aspect of the thigh (Fig. 3) and the deltoid or triceps muscle of the arm (Fig. 4). These areas are easily accessible, the muscles are large and well perfused, and there are few important structures at risk of damage. The injections can be given through clothing. Because of epinephrine's short duration of action (10 to 20 minutes), repeat doses may be necessary if medical support is not promptly available. Repeat doses may also be needed if the patient's symptoms are severe.⁴ The Twinject auto-injector contains 2 doses of epinephrine, and step-by-step instructions are provided on the injector itself. The EpiPen system can be purchased in a package of 2 injectors.

In the dental setting, IV injections of epinephrine should be given only if staff members are familiar with running IV lines. The concentration of epinephrine for IV use should be 1:10000, to avoid localized vasoconstriction that could slow the drug's distribution throughout the body. When administered by this route, adverse effects can be minimized³ by giving the epinephrine in smaller

(0.1 mg) doses or by slow infusion until the desired effect is reached.

In summary, epinephrine is an important drug in the treatment of several medical emergencies. It may be given by the IV, IM or intralingual routes of administration, but familiarity with the drug and the chosen method of delivery are crucial for patient safety. ♦

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Dr. Nkansah's half-day session at the ODA annual meeting, titled "Medical emergencies in the dental office: are you ready?," will be presented on Friday, April 7.

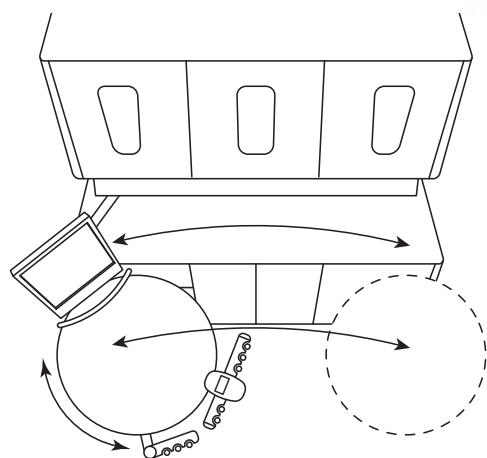
References

1. Haas D. Emergency drugs. *Dent Clin North Am* 2002; 46(4):815-30.
2. Malamed SF. Medical emergencies in the dental office. 5th ed. St. Louis: Mosby; 2000. p. 64-75.
3. Rosenberg MB. Drugs for medical emergencies. In: Yagiela JA, Dowd FJ, Neidle EA, editors. *Pharmacology and therapeutics for dentistry*. 5th ed. St. Louis: Elsevier Mosby; 2004. p. 859-62.
4. Korenblat P, Lundie MJ, Dankner RE, Day JH. A retrospective study of epinephrine administration for anaphylaxis: how many doses are needed? *Allergy Asthma Proc* 1999; 20(6):383-6.



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QUESTION 3

How can I better understand and care for a patient with a mental illness?

Background to the Issue

Psychediatric disease and dental disease are 2 of the most prevalent types of health problems in Canadian society today. Mental illness and the resulting disabilities inflict immeasurable difficulties on patients, their families and their friends, not the least of which is the stigma associated with such conditions.

One in 5 adult Canadians will suffer from some form of mental illness in any given year, and many of these people will not receive treatment until many years after the onset of illness. Thus, every oral health practice can be expected to include patients with some form of mental illness. Many of these patients will appear healthy despite their ongoing emotional disorder. Mental health and oral health are intertwined and can have significant

interactions. The medications used to treat various forms of mental illness may interact with the drugs used in dentistry. Oral health problems can arise as manifestations of mental illness or may occur as side effects of psychiatric medications. Finally, psychiatric disorders often lead to decreased compliance with preventive oral care and decreased ability to obtain or tolerate oral health treatment. The end result can be truly devastating, particularly for younger patients.

Management of the Issue

Dental treatment staff need to become more aware of and sensitive to the vulnerability factors and psychological problems of individual patients and their implications in terms of presenting signs and symptoms and treatment planning.

Table 1 Common psychiatric medications and their impact on dental care

Medication	Oral side effects
Antipsychotics	
<i>Conventional</i>	
Chlorpromazine, haloperidol, perphenazine	Xerostomia, tardive dyskinesia (movement disorders)
<i>Atypical</i>	
Clozapine, olanzapine, quetiapine, risperidone	Xerostomia, dysphagia, stomatitis, dysgeusia
Mood stabilizers	
Lithium	Xerostomia, lichenoid stomatitis, metallic taste
Antidepressants	
<i>Tricyclic antidepressants</i>	
Amitriptyline, clomipramine, imipramine	Xerostomia, possible potentiation of pressor effects of epinephrine in local anesthetics; use of levonordefrin contraindicated; use of retraction cord with epinephrine contraindicated
<i>Monoamine oxidase inhibitors (MAOIs)</i>	
Moclobemide, phenelzine	Xerostomia, possible potentiation of pressor effects of epinephrine in local anesthetics; use of levonordefrin contraindicated; use of retraction cord with epinephrine contraindicated
<i>Selective serotonin reuptake inhibitors (SSRIs)</i>	
Bupropion, citalopram, fluoxetine, paroxetine, sertraline, venlafaxine	Xerostomia, dysgeusia, stomatitis, glossitis, bruxism

Specific concerns in providing treatment might include dealing with patients who have a history of physical or sexual abuse and who may therefore be uncomfortable with the close contact that is inherent in otherwise routine dental procedures. In this situation, a step-by-step description of the procedures that will be done may be required to help the patient relax. A history of substance abuse (seen in over one-third of patients with depression) may result in behavioural problems or early cognitive impairment, which may make it difficult to provide treatment. In addition, the dentist may need to ascertain current liver function status and possible liver disease (e.g., bleeding problems) through consultation with the patient's physician. Eating disorders, particularly bulimia, may lead to enamel erosion, primarily of the lingual surfaces of the maxillary teeth. This problem can present a distinctly sensitive ethical dilemma in the case of a younger patient, particularly if the family is as yet unaware of the disorder. Initiation of dialogue with such patients is a difficult yet important first step to engage their trust and confidence before appropriate referral to a multidisciplinary team (which might include a psychologist, psychiatrist, and nutritionist, among others) in an attempt to end the destructive behaviour. Many patients with mood disorders (e.g., major depression, bipolar disorder) are uninterested in oral hygiene, which contributes to progressive periodontal problems and an increased rate of dental caries. One of the

most frequently reported side effects of antipsychotic and antidepressant medications is xerostomia (Table 1). Various preventive protocols are available for the management of dry mouth, including use of oral moisturizers and saliva substitutes, frequent sipping of water, use of adjunctive fluoride-containing agents (gels, rinses, varnishes or toothpastes) and frequent recall appointments.

With enhanced knowledge of various mental illnesses, the dental treatment team can safely and compassionately contribute to the overall psychotherapeutic management of patients presenting with underlying psychiatric illness. ♦

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Dr. Clark's full-day session at the ODA annual meeting, titled "Depression, anxiety, dementia and dentistry", will be presented on Thursday, April 6.

Further Reading

Burkhart N, Roberts M, Alexander M, Dodds A. Communicating effectively with patients suspected of having bulimia nervosa. *J Am Dent Assoc* 2005; 136(8):1130-7.

George S, Saksena A, Oyeboode F. An update on psychiatric disorders in relation to dental treatment. *Dent Update* 2004; 31(8):488-90, 493-4.

Litch B. Treating patients with mood disorders: a guide for the dental practitioner. *AGD Impact* 2005; 33(4). Available from: URL: <http://www.agd.org/library/2005/april/litch.asp> (accessed January 3, 2006).

QUESTION 4

What topics should I discuss with patients who have both diabetes and periodontal disease, and how will the presence of diabetes affect management of their periodontal problems?

Background to the Problem

There has been an accumulation of data suggesting that periodontal diseases not only affect oral health but might also have a negative impact on systemic health and overall well-being. Several disorders have been linked to periodontitis, and it has been suggested that patients with this condition may be more susceptible to heart disease, stroke, osteoporosis and diabetes mellitus. In fact, there may be a bidirectional relationship between diabetes and periodontitis, such that exacerbation of one can lead to worsening of the other, while treatment of one condition might improve treatment outcomes for the other.^{1,2}

Assessing the Problem

In light of the foregoing, patients and clinicians face several questions relating to the interactions between periodontitis and diabetes and the management of the 2 conditions when they present concurrently.

Is there a relationship between gum disease and diabetes?

Yes, there is a relationship between these conditions, and it seems to go in both directions. That is, if a patient has diabetes, he or she is at greater risk of periodontal disease; conversely, if a patient already has gum disease along with diabetes, the gum disease may be more severe than if he or she

did not have diabetes. Furthermore, treatment of periodontal disease is more difficult in a patient who has poorly controlled diabetes.

What would make you suspect that a patient has diabetes?

If a patient has been seen in your practice for years and has never had periodontal problems, or has had only minor periodontal problems that have quickly become more severe (Fig. 1), you should suspect a systemic condition, such as diabetes. Suspecting diabetes is even more important if the patient smokes, since smokers who have diabetes are at the greatest risk for periodontal problems. If the patient has gained weight or has other symptoms (polyuria, for example), it might be wise to mention the possibility of diabetes and suggest that this be assessed by the patient's physician.

What if the patient tells me that he or she has diabetes that is "under control," but I still have strong suspicions that it's not under control, given worsening of a periodontal condition?

In this situation, you should ask the patient to see his or her physician to determine whether glucose is in fact being controlled effectively. One of the most reliable tests of glucose control involves determining the level of glycated hemoglobin (hemoglobin A1c). Glycated hemoglobin (Fig. 2) is a protein formed by reaction of amino acid side chains with glucose molecules, particularly during periods when serum glucose is high. Glycated hemoglobin has a long half-life in serum. For a patient with "borderline" diabetes, a random blood sugar measurement might be normal. However, if the patient has relatively short peaks of high blood sugar, more hemoglobin A1c will be formed and will stay in the blood for several weeks. Hence, measurement of hemoglobin A1c gives a more accurate assessment of the patient's sugar control than random measurement of blood glucose levels. You or the patient can request this test when talking to the patient's physician.



Figure 1: Photograph of a patient with diabetes and periodontitis. Although there are obvious local factors, this patient's condition is undoubtedly related to worsening of glycemic control, and hence, elevated levels of glycated hemoglobin.

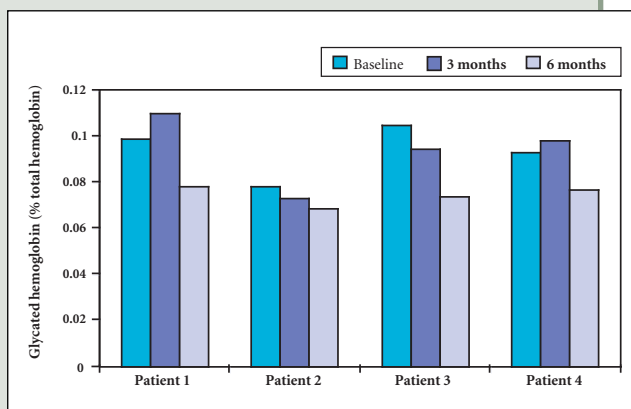


Figure 2: Preliminary data from an in-office research program shows reduction in glyccated hemoglobin levels after periodontal therapy in the 4 patients treated to date.

Does treatment of periodontal disease in a patient with diabetes have any effect on the diabetes?

Yes, there is now ample evidence that elimination of periodontitis will lead to improvement in glucose control, with concomitant improvements in hemoglobin A1c.³ Even minor reductions in hemoglobin A1c can lead to dramatic reductions in many of the more severe but late complications of diabetes including blindness, kidney disease, high blood pressure and cardiovascular disease.⁴ In fact, it is a good idea to confer with the physicians with whom you work, suggesting that if a patient with diabetes is having trouble with blood sugar control, a full dental examination might be warranted.²

Preliminary findings of a double-blind, randomized study carried out by one of the authors (MG) have also confirmed that glyccated hemoglobin levels can be reduced following treatment of periodontitis. These results were obtained in patients treated with scaling and root planing plus metronidazole (vs. a placebo). Metronidazole, unlike doxycycline, does not interfere with protein glycation. The reductions in glyccated hemoglobin

levels were therefore attributed to improvements in diabetes parameters and reductions in the indicators of periodontal disease as opposed to drug-mediated inhibition of protein glycation.

Does treatment of diabetes lead to improvements in periodontal health?

There is also good evidence that when diabetes is well controlled, the patient's periodontitis can be treated much more easily. In some cases, the periodontitis will almost resolve on its own, with only minor intervention, once the diabetes has been controlled. ♦

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Dr. Tenenbaum's half-day session at the ODA annual meeting, titled "The link between oral and systemic health: periodontal disease and the compromised patient", will be presented on Friday, April 7.

References

1. Kiran M, Arpak N, Unsal E, Erdogan MF. The effects of improved periodontal health on metabolic control in type 2 diabetes mellitus. *J Clin Periodontol* 2005; 32(3):266-72.
2. Ueta E, Osak T, Yoneda K, Yamamoto T. Prevalence of diabetes mellitus in odontogenic infections and oral candidiasis: an analysis of neutrophil suppression. *J Oral Pathol Med* 1993; 22(4):168-74.
3. Grossi SG, Skrepcinski FB, Decaro T, Robertson DC, Ho AW, Dunford RG, and other. Treatment of periodontal disease in diabetics reduces glyccated haemoglobin. *J Periodontol* 1997; 68(8):713-9.
4. Clark CM, Lee DA. Prevention and treatment of complications in diabetes. *New Engl J Med* 1995; 332(18):1210-7.



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The Importance of Recognizing Pathology Associated with Retained Third Molars

Albert J. Haddad, DMD, MSc, FRCD(C), FADSA; **Reena M. Talwar, DDS, PhD;**
Cameron M.L. Clokie, DDS, PhD, FRCD(C), FICD(C), FADI, Dip ABOMS

"Clinical Showcase" is a series of pictorial essays that focus on the technical art of clinical dentistry. The section features step-by-step case demonstrations of clinical problems encountered in dental practice. If you would like to propose a case or recommend a clinician who could contribute to this section, contact editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca.

The presence of either partially erupted or fully impacted third molars often prompts a visit to the dental office. Patients may experience symptoms ranging from pain to mild or moderate trismus or even acute infection with purulence at the site of the involved tooth. In such instances, immediate treatment is often necessary to alleviate or resolve the patients' presenting complaint. In the situation of completely impacted third molars, the clinician must make the patient aware of the presence of the impacted wisdom teeth and the presence or absence of any associated pathology. The prophylactic removal of impacted wisdom teeth is often suggested to prevent problems such as infection, carious lesions, destruction of adjacent teeth, periodontal defects involving adjacent teeth, cysts or tumours.¹ Because a large number of wisdom teeth remain impacted or partially impacted (84%) rather than erupting completely (16%), it is important that retained wisdom teeth be carefully monitored for signs of pathology.² As a result, it is important that patients undergo panoramic radiography as part

of the initial evaluation when third molar symptoms are part of the chief complaint. Also, the need for proper referral if pathology is suspected, as well as appropriate radiographic follow-up, must be recognized.

Figures 1 to 3 illustrate lesions associated with partially erupted or impacted third molars that might be missed if periapical radiographs alone are used for routine dental evaluation. Further radiographic assessment of some lesions (Fig. 2), including computed tomography or cone beam scanning may be indicated before surgical intervention. If some lesions are not detected early, they can continue to grow. In Fig. 3, for example, because the lesion appears distal to the crown of the tooth, it might not have been detected with periapical radiography, which would have allowed further enlargement of the cyst and increased morbidity. The presence of large pathologies such as ameloblastoma or odontogenic keratocyst can lead to destruction of a large portion of the mandible, and resection and reconstruction of the affected bone may be required.



Figure 1: Panoramic radiograph shows a well-defined radiolucent lesion at the apex of tooth 38 which might have been missed on a periapical radiograph.



Figure 2: Panoramic radiograph showing a radiolucent lesion between teeth 38 and 37. Even with panoramic radiography, this lesion might be mistaken for a normal anatomic variation.



Figure 3: This radiograph demonstrates enlargement of the follicular space suggestive of a dentigerous cyst.

Case Report

Figures 4 to 24 illustrate a situation in which an abnormality associated with an impacted third molar tooth went undetected for several years because of a lack of appropriate radiographic assessment. As a result, the patient had to undergo significant surgical resection and reconstruction.

An otherwise healthy 17-year-old woman presented with a large radiolucent lesion of the right mandibular body and ramus, involving the coronoid process and sigmoid notch area. Radiographic examination revealed that tooth 48 was impacted within the lesion. There was also evidence of radicular resorption of teeth 46 and 47. Clinical examination revealed expansion of the mandibular body, which was palpable intraorally and along the inferior border of the mandible. The examination was supple-

mented by computed tomography, which helped to define the extent of the pathology.

Before a definitive treatment plan was established, incisional biopsy was performed, and a diagnosis of follicular-type ameloblastoma was confirmed. The treatment plan included resection of the mandibular ramus and body and immediate reconstruction of a microvascular fibular flap. To help minimize functional and esthetic deficits, a 3-D acrylic model was fabricated preoperatively to assist in the overall surgical plan.

The surgical treatment involved a multidisciplinary approach: a plastic surgical team harvested the fibular flap, and the mandible was resected by the oral and maxillofacial surgery team. Figures 7 to 22 illustrate the step-by-step removal of the lesion and reconstruction of the mandible.



Figure 4: Impacted tooth 48 is apparent within a large radiolucent lesion of the right mandibular body and ramus. There is also evidence of radicular resorption of teeth 46 and 47.



Figure 5: This mirror-image model allowed for prebending of the reconstruction plate, which was needed for fixation of the vascularized fibular flap to the native mandible.



Figure 6: This photograph shows the reconstruction plate bent to reproduce an appropriate mandibular contour. The expansion of the mandibular body at the site of the abnormality can also be appreciated in this view.



Figure 7: An incision is made around the intraoral extension of the lesion where the biopsy was performed. Frozen sections were taken to confirm that the soft tissues were free of pathology.

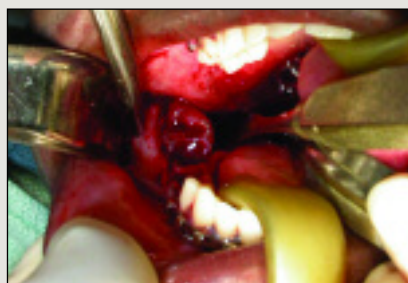


Figure 8: The teeth anterior to the planned resection margin are removed, as is the soft-tissue portion of the lesion to allow for closure over the defect.



Figure 9: The area is sutured to prevent communication between the intraoral and extraoral approaches to the mandible.



Figure 10: The mandible is placed into intermaxillary fixation to prevent postoperative malocclusion after the mandibular reconstruction.



Figure 11: The fibula is harvested through a lateral approach while the mandible is being resected.



Figure 12: Landmarks are identified to protect structures such as the marginal mandibular branch and the temporal branch of the facial nerve.



Figure 13: The platysma muscle is exposed through the submandibular approach to the mandibular body. Careful dissection is necessary to protect the mandibular portion of the facial nerve as well as the facial artery and vein.

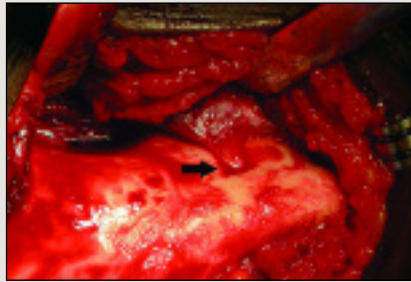


Figure 14: The mandible is exposed and the mental nerve identified as it exits the mental foramina (arrow). The nerve will be sectioned and marked to allow for repair after the mandibular resection.



Figure 15: An anterior resection osteotomy is created to allow removal of the affected ramus and body.



Figure 16: A medial view of the resected specimen shows expansion of the mandibular body and obliteration of the coronoid process and sigmoid notch.



Figure 17: A digital radiograph of the specimen after its removal.



Figure 18: The fibula is harvested with the vascular pedicle intact (arrow).



Figure 19: The fibula is shortened and an osteotomy created to reproduce the mandibular angle. The segments are fixed to the reconstruction plate while the vascular pedicle is kept intact to minimize ischemic time.

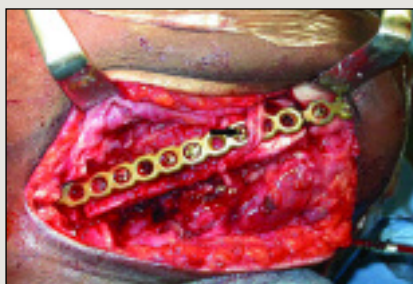


Figure 20: A sural nerve is harvested and used to repair the inferior alveolar nerve, which was removed with the tumour. The arrow highlights the distal portion of the nerve as it travels forward to the mental nerve.



Figure 21: Wound closure, in layers, is accomplished with subcuticular skin sutures to minimize scarring.

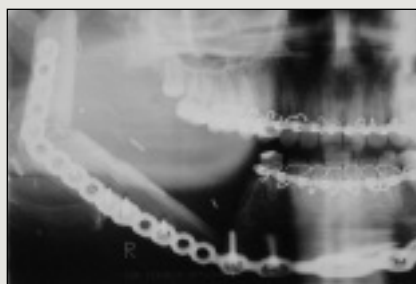


Figure 22: Immediate postoperative panoramic radiograph demonstrates the reconstruction of the mandible with a vascularized fibular flap and reconstruction plate.



Figure 23: Clinical image of the reconstruction site 30 months after surgery shows the triangular-shaped defect in the area of the proposed implant placement.



Figure 24: Bone was harvested from the iliac crest and shaped to reconstruct the defect so that the patient could eventually have an implant-supported restoration in the right posterior mandible.

Discussion

Proper assessment of retained third molars, especially when local symptoms are present, should include a comprehensive clinical and radiographic evaluation. Obtaining a panoramic radiograph at the time of initial evaluation is highly recommended. The limitations of periapical radiography in assessing partially or fully impacted third molars include, but are not limited to, the inability to properly assess the relationship of the tooth to the inferior alveolar nerve canal, the limited ability to evaluate the morphology of the third molar root and the inability to detect abnor-

malities associated with the tooth or teeth in question.

It is the responsibility of the clinician to properly diagnose and manage any pathology associated third molars that are removed. In the case of local pericoronal or periapical lesions associated with impacted third molars, removal of the tooth and biopsy of the soft-tissue lesion should be performed simultaneously. If there is suspicion of a more aggressive pathologic process, appropriate referral should be considered. In this situation, the patient should be made aware of the clinical findings, the various treatment modalities available and the overall prognosis. ➤

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The authors have no declared financial interests.

Dr. Clokie's full-day session at the ODA annual meeting, titled "Oral surgery for the general practitioner", will be presented on Friday, April 7.

References

1. Knutsson K, Brehmer B, Lysell L, Rohlin M. Pathoses associated with mandibular third molars subjected to removal. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996; 82(1):10-7.
2. Venta I, Murtomaa H, Ylipaavalniemi P. A device to predict lower third molar eruption. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997; 84(6):598-603.

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The 2-Tier Dental Health Care System

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Recently, I presented to the Board of Health of the Hastings and Prince Edward Counties Health Unit the results of a survey of dental care among what are classified as high-risk families in one of the health unit's programs.

The survey was piggybacked on the Healthy Babies, Healthy Children (HBHC) Program, which is offered under the Mandatory Health Programs and Services Guidelines of the Ontario Ministry of Health and Long-Term Care. One component of the HBHC Program is a lay home visiting program for high-risk families either before or just after the birth of a child. This contact with high-risk families was identified by the Dental Department of the health unit as an opportunity to obtain information on their access to dental care. With the cooperation of the Department of Nursing and the lay home visitors, families were invited to participate in a short dental questionnaire. To make the questionnaire easy

to both administer and complete, it consisted of just 5 questions:

1. Do you have a dentist?
2. When did you last go to your dentist?
3. Do you think you need to see a dentist now?
4. What, if anything, has stopped you from going to a dentist?
5. If you could get a free [dental] check-up at the health unit, would you go?

The survey started in May 1999 and ended in July 2004. During this period there were 1,186 home visits, and 251 parents (21%)

agreed to participate in the survey. The results of the survey can be summarized as follows:

- 53% of respondents had an established relationship with a dental practice
- 28% had seen a dentist in the past year
- 31% had not seen a dentist in the past 3 years
- 40% had not seen a dentist in the past 4 years
- 74% believed that they needed to see a dentist at the time of the survey
- 74% identified cost as the main barrier to obtaining dental care
- 84% would attend a health unit clinic for a free dental examination if such were available.

On an annual basis, Canadians spend in excess of \$7 billion on dental care. In 1998, direct costs for dental care in Canada were second only to the costs of treating cardiovascular disease.¹ These figures suggest that dental care is important to our society in general. Although the survey gathered only limited information, it provides further evidence that vulnerable members of our communities are excluded from a level of care that society considers important.

As a profession, we defend the existing private-sector dental health care system, which is based on the ability of individuals to pay for care on a fee-for-service basis. However, we know that only 53% of Canadians are covered by a dental benefit program; 80% of high-income individuals 25 to 44 years of age but only 11% of low-income elderly patients have dental coverage²; and factors influencing visits to physicians (including age, income and

IN A SURVEY OF HIGH-RISK FAMILIES, 84% OF RESPONDENTS SAID THEY WOULD ATTEND A HEALTH UNIT CLINIC FOR A FREE DENTAL EXAMINATION IF SUCH WERE AVAILABLE.

health status) have become barriers to accessing oral health care.³ It is argued that keeping oral health care out of the universal health care system has created a 2-tier oral health care system to which wealthy people and employed individuals with dental benefits have easy access but which presents barriers to care for others in our community, most notably the unemployed, the working poor, single-parent families, members of First Nations communities, recent immigrants and elderly people. In fact, our dental health care system serves a continuum ranging from those who can readily access care to those who cannot. Regrettably, dentistry is an example of the “inverse care law,” whereby those with the greatest need of services tend to be those with the least ability to pay for them.

The existence of an inequitable dental health care system is not the only ramification of dentistry operating outside the universal health care system. Access to hospital facilities has been reduced or eliminated, research funding for dentistry is limited, the cost of tuition has increased and the resulting debt load carried by newly qualified dentists affects their ability and interest in following careers in lower-paying specialties and academia. Our profession faces a real challenge in working toward equitable access to dental health care for all Canadians and integration of the dental health care system into our general health care system. ♦

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The views expressed are those of the author and do not necessarily reflect the opinions or official policies of the Canadian Dental Association.

References

1. Baldota KK, Leake JL. A macroeconomic review of dentistry in Canada in the 1990s. *J Can Dent Assoc* 2004; 70(9):604-9.
2. Locker D, Matear D. Oral disorders, systemic health, well-being and the quality of life: a summary of recent research evidence. Community Health Services Research Unit. Faculty of Dentistry, University of Toronto; 2001. p. 21. Available from: URL: <http://www.caphd-acsdpc.org/oh-summa.pdf> (accessed January 4, 2006).
3. Sabbah W. Utilization of dental care services; an analysis of the Canada Health Survey 1994 [dissertation]. Toronto (ON): University of Toronto; 1998. p. 101.

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Do Eating Disorders and Chronic Facial Pain Coexist? A Preliminary Study

Michael B. Goldberg, MSc, DDS, Dip Perio; Debra K. Katzman, MD, FRCPC;
D. Blake Woodside, MD, FRCPC; Gerald I. Baker, DDS, MS, FRCD(C), FICD

Abridged Version

The complete article can be viewed on the eJCDA Web site at www.cda-adc.ca/jcda/vol-72/issue-1/51.html

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ALMOST 70% OF
PATIENTS IN THE EATING
DISORDER POPULATION
REPORTED EXPERIENCING
SOME FORM OF FACIAL
PAIN CURRENTLY OR
IN THE RECENT PAST.

Eating disorders are a complex of illnesses that primarily affect young women and are occurring with increasing frequency. It is commonly believed that many patients with anorexia nervosa also complain of symptoms related to chronic musculoligamentous pain. Chronic facial pain, especially temporomandibular disorders (TMD), is often exacerbated by jaw movements. The facial pain is frequently associated with the muscles of mastication or the temporomandibular joint(s) or both. To date, no studies have investigated the coexistence of these disorders. Both conditions are chronic, possess an underlying psychological component to their origin and are associated with other psychiatric comorbidities.

Chronic facial pain may interfere with the management of an eating disorder.

Objective: To determine the prevalence of chronic facial pain in a population of patients with eating disorders. In addition, eating disorder symptoms were investigated in a patient population with chronic facial pain.

Methods: The study group was composed of 110 patients from 2 eating disorder programs and 78 patients from a chronic facial pain treatment centre. Both groups received 2 standardized questionnaires, the Eating Attitudes Test 26 (EAT-26) and the Hapak questionnaire, to determine the

presence of symptoms associated with an eating disorder or a TMD, respectively.

Results: Using a digital analog scale, 60.9% of patients in the eating disorder population reported experiencing some form of facial pain currently or in the recent past. Of these patients, 67.1% were currently in pain, and 67% of those currently in pain suffered from moderate to severe facial pain. A number of pain locations, symptoms and source(s) were noted using the Hapak questionnaire. Most pain complaints (88.9%) were associated with either the temporomandibular joint or the facial region. Only 2 patients in the chronic facial pain population scored above the threshold for significant eating disorder symptoms.

Discussion: This study found a high percentage of patients presenting to an eating disorders program who also suffered from moderate to severe facial pain, highlighting the coexistence of these conditions. These results underscore the need for health care providers to inquire about the presence of facial pain in patients with eating disorders, as facial pain could have a negative influence on the treatment of the eating disorder. However, this comorbidity requires further exploration including replication of these findings to understand the nature of the coexistence of the conditions. Ideally, a clinical examination should be included in future studies of this association. Ultimately, treating patients with chronic facial pain may have implications in the treatment of people suffering from eating disorders. ➤



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Prions in Dentistry — What Are They, Should We Be Concerned, and What Can We Do?

Amir Azarpazhooh, DDS; James L. Leake, DDS, MSc, DDPH, FRCD(C)

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ABSTRACT

Objective: To briefly review the characteristics of prions, the risk of transmission and implications for infection control in dentistry.

Methods: The literature on prion disease in the context of dentistry up to March 2005 was reviewed using the PubMed, MEDLINE, Cumulative Index to Nursing & Allied Health Literature, Google Scholar databases and the Web sites of the departments of health of countries affected by the disease.

Results: The sporadic form of Creutzfeldt-Jakob disease (CJD) is the most common human prion disease; the mean age of those affected to date is 68 years, the mortality rate is 85% within 1 year, and the average death rate is 1 per million persons. Variant CJD (vCJD) affects people (mean age 26 years) with a history of previous extended periods of residence in certain countries, mainly in the United Kingdom. Currently, there is no evidence of human-to-human transmission of CJD or vCJD following casual or intimate contact or blood transfusion, nor is there evidence of iatrogenic transmission of vCJD in a health care setting. Furthermore, there is no evidence indicating increased occupational risk of CJD or vCJD among health workers or clustering of vCJD among people associated with a dental practice. The risk of transmission of prions through dentistry is unknown but is thought to be very low if appropriate infection control measures are taken.

Conclusions: The theoretical risk of transmission of prion disease through dental treatment emphasizes the need to maintain optimal standards of infection control and decontamination procedures for all infectious agents, including prions.

MeSH Key Words: dental care; infection control, dental; prion diseases/transmission; risk factors

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This article has been peer reviewed.

Prion diseases were first discovered by Stanley B. Prusiner, who won the 1997 Nobel Prize in Physiology or Medicine. Prusiner defined prions as infectious, transmissible proteinaceous particles that lack nucleic acid and are composed exclusively of a modified isoform of the noninfectious cellular prion protein (PrP^C). The pathogenic (also called scrapie or PrP^{Sc}) form of the prion protein (PrP) has the same amino acid content but a higher β -sheet content than PrP^C.¹ Prions cause a group of fatal neurodegenerative diseases in humans and animals called transmissible spongiform encephalopathies (TSEs). Upon post-mortem examination of

those who die from these diseases, the brains appear normal.² However, histopathologic examination reveals an accumulation of PrP^{Sc} in the central nervous system and microscopic vacuoles within the grey matter, resulting in widespread spongiform morphology of the brain.^{2,3} The various forms of TSE are summarized in Table 1.

The prevalence of prion disease in North America is very low, so dental practitioners must learn from the experience of countries that have already been affected by the disease, to ensure the security and safety of patients as well as staff.

Table 1 The prion diseases

Disease	Mechanism of pathogenesis
Human diseases	
Kuru (Fore people)	Infection through ritualistic cannibalism
Iatrogenic Creutzfeldt-Jakob disease	Infection through prion-contaminated HGH, dura mater grafts, and so forth
Variant Creutzfeldt-Jakob disease	Infection through bovine prions?
Familial Creutzfeldt-Jakob disease	Germline mutations in PrP gene
Gerstmann-Sträussler-Scheinker disease	Germline mutations in PrP gene
Fatal familial insomnia	Germline mutations in PrP gene (D178N and M129)
Sporadic Creutzfeldt-Jakob disease	Somatic mutation or spontaneous conversion of PrP ^C into PrP ^{Sc} ?
Animal diseases	
Scrapie (sheep)	Infection in genetically susceptible sheep
Bovine spongiform encephalopathy (cattle)	Infection with prion-contaminated MBM
Transmissible mink encephalopathy (mink)	Infection with prions from sheep or cattle
Chronic wasting disease (mule deer, elk)	Unknown
Feline spongiform encephalopathy (cats)	Infection with prion-contaminated MBM
Exotic ungulate encephalopathy (greater kudu, nyala, oryx)	Infection with prion-contaminated MBM

HGH = human growth hormone; MBM = meat and bone meal feed

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Although the risk of transmission of Creutzfeldt-Jakob disease (CJD) through dentistry is unclear, the theoretical risk of transmission through any contaminated instruments provides some insight. Prions are highly resistant to inactivation and can survive autoclaving even at high temperatures; therefore, dentists and members of their dental teams should be aware of the precautions and principles of appropriate infection control to minimize iatrogenic transmission of prions.

The literature search for this article covered studies of human and animal TSEs relevant to the field of dentistry up to March 2005, on the basis of the PubMed, MEDLINE, Cumulative Index to Nursing & Allied Health Literature, Google Scholar databases and the Web sites of the departments of health of countries that have been affected by the disease. This review article is intended to provide dentists with a brief overview of the characteristics of prions, the risk of transmission and the implications for infection control in dentistry. Although animal forms of TSEs — bovine spongiform encephalopathy (BSE) and scrapie — are important diseases, this review is limited to human forms.

Human TSEs

CJD is actually a group of diseases divided into sporadic (sCJD), inherited (Gerstmann-Sträussler-Scheinker syndrome and fatal familial insomnia) and acquired (iatrogenic, kuru, variant CJD [vCJD]) forms. Eighty-five per cent of cases of CJD are sporadic; up to 15% are

familial, linked to genetic mutations of PrP, and less than 1% are iatrogenic.⁴

As of May 1, 2004, the incidence of CJD death reported to the Creutzfeldt-Jakob Disease Surveillance System (CJD-SS) of Health Canada was 31 in 1999, 35 in 2000, 30 in 2001, 36 in 2002, and 29 in 2003.⁵ The Canadian epidemiological rate is the same as the worldwide rate of about one death per million persons, adjusted for age.^{5,6} Table 2 summarizes the clinical features of human prion diseases.

Sporadic Form of CJD

Sporadic cases of CJD occur spontaneously, without any apparent reason. The mean age of patients with sCJD is 68 years.¹⁰ The mortality rate is 85% within 1 year, and the diagnosis is best ascertained during the final stages of the disease, at or near the time of death.^{6,10}

Acquired Forms

Kuru

Kuru, first described in the 1950s, is an acquired human TSE, geographically restricted to the Okapa area of the eastern highlands of Papua New Guinea. It resulted from cannibalism (specifically the consumption of deceased relatives' tissues as a form of respect).⁷ Cannibalism was banned in 1956, which resulted in a decrease in the annual incidence from approximately 1% in 1957 to the current rate of about 5 cases per annum.¹¹

Table 2 Clinical features of human prion diseases

	Age at onset (yr)	Incubation time (yr)	Duration of disease (mo)	Clinical stages	
CJD	60–69	Not recorded	3–6	Early	Lapses in memory, mood swings (similar to depression), lack of interest, social withdrawal and unsteadiness
				Late (neurological)	Blurred vision, sudden jerking movements and rigidity in the limbs, slurred speech, difficulty swallowing, progressive mental deterioration, and, eventually, immobility and muteness
vCJD	20–29	> 4	9–35	Early (psychiatric)	Mostly depression, with (less often) a schizophrenia-like psychosis; for half of cases, unusual sensory signs, such as “stickiness” of the skin
				Late (neurological)	Unsteadiness, difficulty walking and involuntary movements as the illness progresses; in final stages, complete immobility and muteness
Kuru	>20	Mean: 12	6–36	Early	Cerebellar syndrome; communication difficulties due to severe dysarthria
				Late	Progression to total incapacitation and death in final stages

CJD = Creutzfeldt–Jakob disease, vCJD = variant Creutzfeldt–Jakob disease.

Source: Will,⁷ Kompoliti and others,⁸ Porter⁹

Variant Creutzfeldt–Jakob Disease

In 1996, the National Creutzfeldt–Jakob Disease Surveillance Unit in the United Kingdom identified 10 cases of CJD with a specific neuropathological profile and called them variant CJD. These patients had a lower age at onset (median age 26 years) than was the case for CJD,¹⁰ unusual clinical findings and an absence of the typical electroencephalographic (EEG) changes of CJD.¹² Young age, methionine homozygosity at codon 129 of the PrP gene and residence in the United Kingdom are among the risk factors for vCJD.⁷ Consumption of food contaminated with tissues from animals with BSE is likely to initiate vCJD in humans.¹³

By November 2003, a total of 143 confirmed and probable vCJD cases had been recognized in the United Kingdom. Another 10 cases of vCJD had been recognized elsewhere: 6 in France and single cases in Ireland, Italy, Canada and the United States, each with a history of extended periods of residence in the United Kingdom.^{14,15} Because of the ease of global travel and Canada’s open immigration policy, it is possible that other vCJD cases will be seen in Canada.¹⁴

Inherited Forms

Gerstmann–Sträussler–Scheinker syndrome (GSS) and fatal familial insomnia (FFI) are both very rare, with an annual incidence of 1 per 10 million to 100 million people.¹⁶ They occur in people with an apparent hereditary predisposition.¹⁷ However, the mutations responsible for GSS are different from those causing FFI.

Diagnostic Tests

A number of tests and investigations can be used to diagnose vCJD, including blood tests (for inherited prion diseases), EEG (for sCJD), cranial magnetic resonance imaging (for sCJD and vCJD), cerebrospinal fluid tests (sCJD) and tonsillar biopsy (vCJD). However, the definitive diagnosis of vCJD is made at autopsy.¹⁸

Potential Risks

Blood Transfusion

It is not currently possible to firmly conclude that vCJD can be transmitted through blood transfusions or plasma derivatives; as such, this risk is theoretical.^{19–22}

Table 3 Categorization of patients by risk

Patient group	Risk criteria
Symptomatic patients	<ul style="list-style-type: none"> • Patients who fulfill the diagnostic criteria for definite, probable or possible CJD or vCJD • Patients with neurological disease of unknown cause who do not fit the criteria for possible CJD or vCJD, but in whom the diagnosis of CJD is being considered
Asymptomatic patients at risk for familial forms of CJD linked to genetic mutations	<ul style="list-style-type: none"> • Individuals who have or have had 2 or more blood relatives affected by CJD or another prion disease or a relative known to have a genetic mutation indicative of familial CJD • Individuals who have been shown by specific genetic testing to be at significant risk of CJD or another prion disease
Asymptomatic patients potentially at risk because of iatrogenic exposure ^a	<ul style="list-style-type: none"> • Recipients of hormone derived from human pituitary glands, e.g., growth hormone, gonadotropin • Individuals who have received a graft of dura mater (people who underwent neurosurgical procedures or operations for a tumour or cyst of the spine before August 1992 may have received a graft of dura mater and should be treated as being at risk, unless there is evidence that dura mater was not used) • Patients who have been identified as potentially at risk because of exposure to instruments used on, or receipt of blood, plasma derivatives, organs or tissues donated by, a patient who went on to develop CJD or vCJD^b

CJD = Creutzfeldt-Jakob disease, vCJD = variant Creutzfeldt-Jakob disease.
Adapted with permission from the U.K. Department of Health.³¹

^a A decision on the inclusion of corneal graft recipients in the "iatrogenic at risk" category is pending completion of a risk assessment.

^b The CJD Incidents Panel, which gives advice to the local team on what action is needed when CJD or vCJD is diagnosed in a patient who underwent surgery or donated blood, organs or tissues before the disease was identified, will identify contacts who are potentially at risk.

Transmission of BSE to a single animal through blood transfusion was recently reported,^{23–25} but further studies are needed to identify an actual iatrogenic risk.²⁶ However, at this time, because of the extremely small risk of acquiring vCJD in Canada²⁷ and the current incidence (one case to date), the risk of transmission of vCJD by blood seems extremely low.

Iatrogenic Factors

Iatrogenic transmission of CJD is a rare situation caused by cross-contamination with material in or adjacent to the brain. Examples of cross-contamination include corneal transplant (3 associated cases), contaminated neurosurgical devices (7 cases worldwide, of which 2 are considered probable and 5 possible), contaminated EEG depth electrodes (2 cases), human pituitary growth hormones (about 130 cases worldwide), human gonadotropin (4 cases) and human dura mater grafts (about 110 cases worldwide).^{7,16,26}

Human-to-Human Contact

Currently, there is no evidence of human-to-human transmission of CJD or vCJD following casual (touching or kissing) or intimate (sexual) contact.^{11,19}

Assessment of a Patient's Risk for CJD

The World Health Organization (WHO) Consultation on Infection Control Guidelines for Transmissible Spongiform Encephalopathies, held in March 1999, defined patients with diagnosed or suspected CJD as having high risk; recipients of human dura mater grafts, corneal grafts and human pituitary hormones, as well as members of families with familial CJD, GSS and FFI, were defined as at risk (but only under conditions in which there could be exposure to their high-infectivity tissues, including cerebrospinal fluid).²⁸ However, the current incidence of CJD in Canada does not justify classifying people who have undergone neurosurgical procedures as being at risk.²⁷

Risk among Health Care Workers

Although there is no epidemiological evidence indicating increased occupational risk of CJD or vCJD among health care workers, including dental practitioners, the possibility cannot be excluded.²⁸ Currently, there is no evidence of clustering of vCJD in people associated with a dental practice,²⁹ nor is there evidence of iatrogenic transmission of vCJD, although it could be masked by the

long incubation period.³⁰ At present, there is no evidence that saliva is infective.³¹ At autopsy, vCJD PrP has not been detected in the alveolar nerve, tongue, dental pulp, gingiva or salivary glands.^{16,31,32} However, animal studies have shown that the oral tissues can become infected with prions and can be a potential source of infection for other animals.²⁹

TSEs and Dental Patients

Oral Manifestations of Prion Disease

Pseudobulbar palsy may cause dysphagia and dysarthria in patients with TSEs. Orofacial dysesthesia or paresthesia, as well as loss of taste and smell (in one case), have been reported in patients with vCJD.^{29,33}

Assessing the Risk of Transmission through Dentistry

At the time of this review, the risk of acquiring vCJD in Canada was extremely small.²⁷ The risk of transmission of prions through dental treatment is unknown, but it is thought to be very low if optimal standards of infection control and decontamination are maintained.³⁴

Sogal and Tofe³⁵ conducted a risk analysis to assess the possibility of TSE transmission from a commercially available bovine-derived xenogenic bone substitute that is popular in clinical dentistry. They concluded that the risk of TSE transmission was insignificant, given the strict protocols followed in the sourcing and processing of raw bovine bone for human use.

The UK Department of Health reported that the potential risk of vCJD transmission through re-use of instruments in dental surgery (via tonsillar abrasion) is very low. Even in the most pessimistic scenario of infectivity of dental pulp, the per-operation risk of transmitting vCJD would be at least 10 times lower than that of tonsillectomy, which, in turn, is lower than that of a surgical treatment involving the central nervous system.³⁶

Several case-control studies have found no relationship between tooth extraction, dental surgery or major dental work and human TSEs.^{20,22,37}

In a study conducted in 2003, Head and others³² were unable to detect disease-associated PrP in dental tissues at autopsy of 5 patients with vCJD. In contrast, the tonsils were positive for prions in all cases.

Blanquet-Grossard and others³⁸ analyzed proteinase-K-treated homogenates from the brain and dental pulp of 8 patients with confirmed sCJD. Using Western blotting with the monoclonal 3F4 antibody, they were unable to detect any signal of characteristic proteinase-resistant PrP from approximately 10 mg of dental pulp tissue, but they did detect the signals in 0.01 mg of brain tissue. They pointed out, however, that because the sensitivity of Western blotting is lower than that of the animal bioassay test, the risk of iatrogenic contamination by endodontic surgery could not be rejected.

Animal Studies

In 1978, Adams and Edgar³⁹ assessed the possibility of transmission of scrapie through dental burs. They traumatized the gingival tissue of healthy mice using dental burs that had been contaminated with gingival tissue of infected scrapie mice. Despite the infectivity of the gingival tissue of the infected mice (as confirmed by intraperitoneal injection), they found no clinical or histological findings of scrapie when the healthy mice were killed and examined 15 months later. However, there is some evidence that a significant level of infectivity develops in the gingival and dental pulp tissues of infected animals, and that "TSEs can be transmitted to healthy animals by exposing root canals and gingival abrasions to infectious brain homogenate."²⁸

In 1982, Carp⁴⁰ applied brain homogenates from scrapie-infected mice to the gingiva of 2 groups of healthy mice, one group previously scarified with forceps and scissors and the other not. He reported that 71% of the nonscarified mice became infected, whereas all of the scarified mice became infected; in addition, the incubation period for the second group was significantly shorter than that of the first group. After intracerebral injection of fluid from oral lavage of scarified gingiva of scrapie-infected mice into 31 healthy mice, 3 mice became infected. Carp concluded that the risk of transmission of scrapie through the oral route was high when the scrapie agent was applied in high concentration and the gingiva was scarified.

In 1999, Ingrosso and others⁴¹ conducted a study on the possibility of prion infection through dental procedures. They found a significant level of infectivity in the trigeminal ganglia and in the gingival and pulpal tissues of scrapie-affected hamsters after intraperitoneal inoculation, suggesting possible transmission from the central nervous system through trigeminal nerves toward the oral cavity. They also injected the scrapie agent into the dental pulp of a group of Syrian hamsters, all of which developed the disease. Although these results cannot be generalized to humans affected by TSEs, they point to the possibility that inadequately decontaminated dental instruments may represent a potential route of infection, specifically in vCJD, with has greater infectivity in peripheral tissues than CJD.

Infection Control in Dentistry

Table 3 shows the patient risk categorization of the joint working group of the Advisory Committee on Dangerous Pathogens/Spongiform Encephalopathy Advisory Committee.³¹

That working group stated that for treatment of TSE patients with procedures not involving neurovascular tissue, the general infection control practices recommended by national dental associations are sufficient.^{4,28,31} However, when certain invasive interventions are performed on patients who are at risk, it is essential to implement proper

Table 4 World Health Organization infection control guidelines for transmissible spongiform encephalopathies

Category	Methods
Incineration	<ul style="list-style-type: none"> • Use for all disposable instruments, materials and wastes. • Preferred method for all instruments exposed to high infectivity tissues.
Autoclave and chemical methods for heat-resistant instruments	<ul style="list-style-type: none"> • Immerse in sodium hydroxide (1 N NaOH) and heat in a gravity displacement autoclave at 121°C for 30 min; clean; rinse in water and subject to routine sterilization. • Immerse in NaOH or sodium hypochlorite (20 000 ppm available chlorine) for 1 h; transfer instruments to water; heat in a gravity displacement autoclave at 121°C for 1 h; clean and subject to routine sterilization. • Immerse in NaOH or sodium hypochlorite for 1 h; remove and rinse in water, then transfer to open pan and heat in a gravity displacement (121°C) or porous load (134°C) autoclave for 1 h; clean and subject to routine sterilization. • Immerse in NaOH and boil for 10 min at atmospheric pressure; clean, rinse in water and subject to routine sterilization. • Immerse in sodium hypochlorite (preferred) or NaOH (alternative) at ambient temperature for 1 h; clean; rinse in water and subject to routine sterilization. • Autoclave at 134°C for 18 min (to be used for worst-case scenario; i.e., brain tissue bake-dried on surfaces).
Chemical methods for surfaces and heat-sensitive instruments	<ul style="list-style-type: none"> • Flood with 2 N NaOH or undiluted sodium hypochlorite; let stand for 1 h; mop up and rinse with water. • For surfaces that cannot tolerate NaOH or hypochlorite, thorough cleaning will remove most infective agents by dilution, and some additional benefit may be derived from the use of one or another of the partially effective methods (chlorine dioxide glutaraldehyde, guanidinium thiocyanate [4 mol/L], iodophors, sodium dichloro-isocyanurate, sodium metaperiodate, urea [6 mol/L]).
Autoclave or chemical methods for dry goods	<ul style="list-style-type: none"> • Small dry goods that can withstand either NaOH or sodium hypochlorite should first be immersed in one or the other solution (as described above) and then heated in a porous load autoclave at $\geq 121^\circ\text{C}$ for 1 h. • Bulky dry goods or dry goods of any size that cannot withstand exposure to NaOH or sodium hypochlorite should be heated in a porous load autoclave at 134°C for 1 h.

Source: World Health Organization.²⁸

infection control to reduce the possibility of transmission of TSEs via dental instruments.^{4,31}

Although participants in the WHO Consultation on Infection Control Guidelines for Transmissible Spongiform Encephalopathies were unable to reach agreement on the risk of iatrogenic transmission of TSEs through major dental work, they suggested that single-use items and equipment such as disposable needles and anesthetic cartridges represented the safest method for minimizing the risk of residual infectivity. Despite inability to make a strong recommendation, they did provide a guideline for reusable endodontic files, matrix bands and burs that might become contaminated with neurovascular tissue (Table 4).²⁸ However, the best infection control procedure

(whenever possible) is quarantining instruments, linen, gowns, gloves and masks in a rigid leak-proof combustible clinical waste container after use, and transferring the container to the incinerator as soon as practicable.^{4,28,31,33}

In 2001, the Fédération Dentaire Internationale (FDI) announced a policy statement regarding the prevention of TSEs in dentistry,⁴² suggesting universal precautions, careful history-taking for every dental patient and appropriate continuing education for dentists about the control of cross-infection in dental practice. For at-risk patients, referral to specialist clinics or hospitals and incineration of all instruments and extracted teeth were recommended. It was suggested that animal-derived graft materials not be used in oral or periodontal surgery unless the safety of the

product has been certified. Also, caution should be exercised in the use of heterologous human graft materials.

Recently, the Centers for Disease Control and Prevention (CDC) released guidelines for infection control in dental health care settings that differ in some aspects from the WHO guidelines. When treating patients with known CJD or vCJD, the CDC recommended that dental items that are difficult to clean (such as endodontic files, broaches, and carbide and diamond burs) be discarded after one use. For heat-resistant dental instruments, they suggested thoroughly cleaning and steam-autoclaving the instruments at 134°C for 18 minutes.⁴³

Patients with confirmed prion disease should be scheduled at the end of the day to permit more extensive cleaning and decontamination.^{4,28} It is preferable to avoid activating waterlines because of the risk of retraction of prions in oral fluids. Also, a stand-alone suction unit with disposable reservoir, rather than the suction component of the dental unit, and a disposable bowl instead of the dental unit spittoon should be used.^{16,29,33} To avoid environmental contamination, dental equipment should be adequately shielded using disposable, impermeable cover sheets.²⁸

Conclusions

Recently, there has been an increase in scientific and public awareness about prion disease. Although the prevalence of the disease in North America is low, global travel and Canada's open immigration policy raise the possibility that other vCJD cases will be seen in this country, and these may pose a risk of secondary iatrogenic transmission. The theoretical risk of transmission of prion disease through dental treatment points to the importance of maintaining optimal standards of infection control and decontamination for infectious agents, including prions. ♦

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References

1. Prusiner SB. Prions. *Proc Natl Acad Sci USA* 1998; 95(23):13363–83.
2. Prusiner SB. Prion diseases and the BSE crisis. *Science* 1997; 278(5336):245–51. Available from: URL: www.sciencemag.org.
3. Prusiner SB. Molecular biology and pathogenesis of prion diseases. *Trends Biochem Sci* 1996; 21(12):482–7.
4. Health Canada. Classic Creutzfeldt-Jakob disease in Canada. Infection control guidelines. *Can Commun Dis Rep* 2002; 28S5:1–84. Available from: URL: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/02pdf/28s5e.pdf> (accessed December 22, 2005).
5. Public Health Agency of Canada. Classical Creutzfeldt-Jakob Disease: Creutzfeldt-Jakob Disease Surveillance System(CJD-SS); 2003. Available from: URL: http://www.phac-aspc.gc.ca/hcai-iamss/cjd-mc/cjds_e.html#stats (accessed December 22, 2005).
6. Gibbons RV, Holman RC, Belay ED, Schonberger LB. Creutzfeldt-Jakob disease in the United States: 1979–1998. *JAMA* 2000; 284(18):2322–3.
7. Will R. Acquired prion disease: iatrogenic CJD, variant CJD, kuru. *British Medical Bulletin* 2003; 66:255–65.
8. Kompolti K, Goetz C, Gajdusek D, Cubo E. Movement disorders in Kuru. *Movement Disorders* 1999; 14(5):800–4.
9. Porter SR. Prion disease: possible implications for oral health care. *J Am Dent Assoc* 2003; 134(11):1486–91.
10. From the Centers for Disease Control and Prevention. Probable variant Creutzfeldt-Jakob disease in a US Resident—Florida, 2002. *JAMA* 2002; 288(23):2965–7.
11. Chan SW, Collins S, Masters CL, Walker DM. Classical and variant Creutzfeldt-Jakob diseases and their potential impact on the practice of clinical dentistry in Australia. *Aust Dent J* 2001; 46(4):251–7.
12. Will RG, Ironside JW, Zeidler M, Cousens SN, Estibeiro K, Alperovitch A, and others. A new variant of Creutzfeldt-Jakob disease in the UK. *Lancet* 1996; 347(9006):921–5.
13. Bruce ME, Will RG, Ironside JW, McConnell I, Drummond D, Suttie A, and others. Transmissions to mice indicate that 'new variant' CJD is caused by the BSE agent. *Nat Med* 1997; 398(6650):498–501.
14. Health Canada. First case of variant Creutzfeldt-Jakob disease in Canada. *Can Commun Dis Rep* 2003; 29(13):117–20. Available from: URL: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/03vol29/dr2913eb.html> (accessed December 22, 2005).
15. Spongiform Encephalopathy Advisory Committee. SEAC Annual Report 2003. Available from: URL: <http://www.seac.gov.uk/publicats/annualreport2003.pdf> (accessed December 22, 2005).
16. Keogh PV, Flint SR. Transmissible spongiform encephalopathies and dentistry. *J Ir Dent Assoc* 2004; 50(4):160–2.
17. World Health Organization. Fact sheet n° 113: Bovine spongiform encephalopathy. November 2002. Available from: URL: <http://www.who.int/mediacentre/factsheets/fs113/en/index.html> (accessed December 22, 2005).
18. Smith AJ, Russell DI, Greene J, Lowman A, Ironside JW. Presentation of a case of variant CJD in general dental practice. *Br Dent J* 2004; 197(2):75–6.
19. Health Canada. Advisory notice: infection control for Creutzfeldt-Jakob disease. *Can Commun Dis Rep* 1996; 22(17):147–8. Available from: URL: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/96vol22/dr2217ec.html> (accessed December 22, 2005).
20. Collins S, Law MG, Fletcher A, Boyd A, Kaldor J, Masters CL. Surgical treatment and risk of sporadic Creutzfeldt-Jakob disease: a case-control study. *Lancet* 1999; 353(9154):693–7.
21. Comer P. Risk assessment of exposure to vCJD infectivity in blood and blood products. Report for Department of Health. 2003. Available from: URL: http://www.dnv.com/binaries/vCJD_Update_Report_tcm4-74414.pdf (accessed November 2005).
22. van Duyn CM, Delasnerie-Laupretre N, Masullo C, Zerr I, de Silva R, Wientjens DP, and others. Case-control study of risk factors of Creutzfeldt-Jakob disease in Europe during 1993–95. European Union (EU) Collaborative Study Group of Creutzfeldt-Jakob disease (CJD). *Lancet* 1998; 35(9109):1081–5.
23. Houston F, Foster JD, Chong A, Hunter N, Bostock CJ. Transmission of BSE by blood transfusion in sheep. *Lancet* 2000; 356(9234):999–1000.
24. Hunter N, Foster J, Chong A, McCutcheon S, Parnham D, Eaton S, and others. Transmission of prion diseases by blood transfusion. *J Gen Virol* 2002; 83(Pt 11):2897–905.
25. Taylor DM, Fernie K, Reichl HE, Somerville RA. Infectivity in the blood of mice with a BSE-derived agent. *J Hosp Infect* 2000; 46(1):78–9.
26. Llewellyn CA, Hewitt PE, Knight RS, Amar K, Cousens S, Mackenzie J, and others. Possible transmission of variant Creutzfeldt-Jakob disease by blood transfusion. *Lancet* 2004; 363(9407):417–21.
27. Public Health Agency of Canada. Variant Creutzfeldt-Jakob disease (vCJD) in Canada. Available from: URL: http://www.phac-aspc.gc.ca/cjd-mc/cjd-faq_e.html (accessed December 22, 2005).
28. World Health Organization Consultation. WHO Infection Control Guidelines for Transmissible Spongiform Encephalopathies. [monograph on the Internet].

Geneva, Switzerland: World Health Organization Communicable Disease Surveillance and Control; 1999 [cited 2005 Feb 24]. Available from: URL: <http://www.who.int/csr/resources/publications/bse/whocdscsgraph2003.pdf> (accessed December 22, 2005).

29. Porter SR. Prions and dentistry. *J R Soc Med* 2002; 95(4):178–81.

30. Scully C, Smith AJ, Bagg J. Prions and the human transmissible spongiform encephalopathies. *Dent Clin North Am* 2003; 47(3):493–516.

31. Department of Health, England. Advisory Committee on Dangerous Pathogens and the Spongiform Encephalopathy Advisory Committee. Transmissible spongiform encephalopathy agents: safe working and the prevention of infection. 2003 (Table 4A updated July 2005). Available from: URL: <http://www.advisorybodies.doh.gov.uk/acdp/tseguidance/> (accessed December 22, 2005).

32. Head MW, Ritchie D, McLoughlin V, Ironside JW. Investigation of PrPres in dental tissues in variant CJD. *Br Dent J* 2003; 195(6):339–43.

33. Porter S, Scully C, Ridgway GL, Bell J. The human transmissible spongiform encephalopathies (TSEs): implications for dental practitioners. *Br Dent J* 2000; 188(8):432–6.

34. Gonzales TS, Rushing EJ. Bad news and good news: what the dentist needs to know about transmissible spongiform encephalopathies. *Quintessence Int* 1998; 29(5):319–21.

35. Sogal A, Tofe A. Risk assessment of bovine spongiform encephalopathy transmission through bone graft material derived from bovine bone used for dental applications. *J Periodontol* 1999; 70(9):1053–63.

36. UK Department of Health. Economics and Operational Research Division. Risk assessment for vCJD and dentistry. July 2003. Available from: URL: <http://www.dh.gov.uk/assetRoot/04/07/83/03/04078303.PDF> (accessed December 22, 2005).

37. Kondo K, Kuroiwa Y. A case control study of Creutzfeldt-Jakob disease: association with physical injuries. *Ann Neurol* 1982; 11(4):377–81.

38. Blanquet-Grossard F, Sazdovitch V, Jean A, Deslys JP, Dormont D, Hauw JJ, and others. Prion protein is not detectable in dental pulp from patients with Creutzfeldt-Jakob disease. *J Dent Res* 2000; 79(2):700.

39. Adams D, Edgar WM. Transmission of agent of Creutzfeldt-Jakob disease. *Br Med J* 1978; 1(6118):987.

40. Carp RI. Transmission of scrapie by oral route: effect of gingival scarification. *Lancet* 1982; 1(8264):170–1.

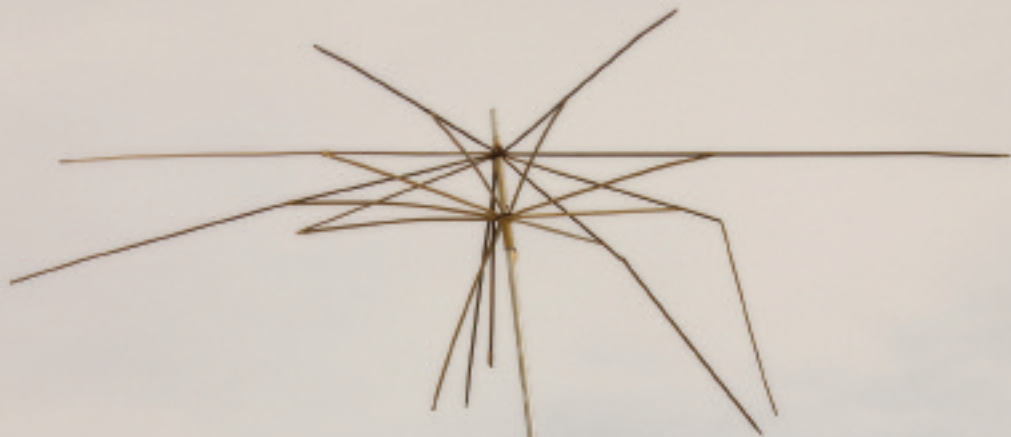
41. Ingrosso L, Pisani F, Pocchiari M. Transmission of the 263K scrapie strain by the dental route *J Gen Virol* 1999; 80(Pt 11):3043–7.

42. Fédération Dentaire Internationale. FDI policy statement on transmissible spongiform encephalopathies: implications for the practice of dentistry. September 2001. Available from: URL: http://www.fdiworldental.org/federation/3_0statements.html.

43. Kohn WG, Collins AS, Cleveland JL, Harte JA, Eklund KJ, Malvitz DM. Guidelines for infection control in dental health-care settings—2003. *MMWR Recomm Rep* 2003; 52(RR-17):1–61.

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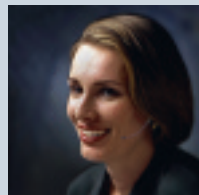
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Blistering Mucocutaneous Diseases of the Oral Mucosa — A Review: Part 2. Pemphigus Vulgaris

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ABSTRACT

Oral mucous membranes may be affected by a variety of blistering mucocutaneous diseases. In this paper, we review the clinical manifestations, typical microscopic and immunofluorescence features, pathogenesis, biological behaviour and treatment of pemphigus vulgaris. Although pemphigus vulgaris is not a common disease of the oral cavity, its potential to cause severe or life-threatening disease is such that the general dentist must have an understanding of its pathophysiology, clinical presentation and management.

MeSH Key Words: mouth diseases; pemphigus/drug therapy; pemphigus/etiology

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The most common blistering conditions of the oral and perioral soft tissues were briefly reviewed in part 1 of this paper (viral infections, immunopathogenic mucocutaneous blistering diseases, erythema multiforme and other contact or systemic allergic reactions).^{1–4} This paper (part 2) focuses on the second most common chronic immunopathogenic disease to cause chronic oral blistering: pemphigus vulgaris.

Pemphigus

Pemphigus is a group of diseases associated with intraepithelial blistering.⁵ Pemphigus vulgaris (variant: pemphigus vegetans) and pemphigus foliaceus (variant: pemphigus erythematosus) are the classically recognized clinical variants, but others are now known, such as IgA pemphigus, paraneoplastic pemphigus and herpetiform pemphigus. Drug-induced pemphigus vulgaris-like lesions are known to be caused by D-penicillamine, but similar lesions have also been reported for

captopril, phenacetin, furosemide, penicillin, tiopronin and sulfones such as dapsone. Oral lesions are commonly seen with pemphigus vulgaris and paraneoplastic pemphigus.⁶

Normal Desmosomes

Adjacent epithelial cells share a number of connections including tight junctions, gap junctions and desmosomes. Desmosomes are specialized structures that can be thought of as spot welds between cells. The intermediate keratin filaments of each cell are linked to focal plaque-like electron dense thickenings on the inside of the cell membrane containing proteins called plakoglobins and desmoplakins. Some of these proteins are linked to glycoproteins, desmogleins and desmocollins, which extend through the cell plasma membrane to a widened zone between the 2 cells called the desmoglea. In this space, the desmogleins and desmocollins join by homophilic binding to link the 2 cell membranes together (Fig. 1). The expression of desmogleins varies between

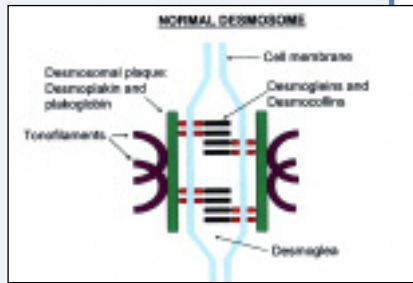


Figure 1: Schematic of a normal desmosome between 2 adjacent epithelial cells.

oral epithelium and skin: oral epithelium contains mostly desmoglein 3, whereas skin contains both desmoglein 3 and desmoglein 1.

Pemphigus Vulgaris

Pemphigus vulgaris is a blistering disease of skin and sometimes of the mucous membranes. It affects both men and women over a wide age range and is extremely variable in severity. Two immune variants are recognized: the mucous membrane predominant type (anti-desmoglein 3 only) and the mucocutaneous type (anti-desmoglein 1 and 3). In the mucocutaneous type, oral ulcerative lesions are often seen before the disease inevitably affects the skin. The condition is seen in a greater proportion in certain ethnic groups, such as those of Mediterranean origin and Ashkenazi Jews, suggesting a genetic predisposition. The disease is less common than mucous membrane pemphigoid (MMP), occurring in about 0.1–0.5 patients per 100,000 population a year.⁷

Patients complain of painful, persistent ulcers and sloughing (Fig. 2a), which may affect any part of the oral cavity but is commonly seen first in the buccal mucosa, palatal mucosa and lips⁷ (Fig. 2b). Occasionally blisters are seen, but these usually rupture quickly and are often unnoticed. The Nikolsky test is positive. The ulcerations may affect other mucous membranes, including the conjunctiva, nasal mucosa, pharynx, larynx, esophagus and genital mucosa, as well as the skin where intact blisters are more commonly seen.⁸

Microscopic Appearance

Biopsy of a blister shows an intraepithelial vesicle containing floating, rounded keratinocytes (Tzanck cells) that have become detached from surrounding cells (acantholysis). The basal layer cells are still firmly attached to the connective tissue, although they may show separation along their lateral plasma membranes. The roof of the blister is tenuous and of variable thickness, or may be absent. Long rete pegs lined by a single layer of basal cells are often present, and there is a mild to moderate chronic

inflammatory infiltrate in the adjacent connective tissue² (Figs. 2c and 2d).

Immunofluorescence Features

Direct immunofluorescence shows binding of IgG and C3 between epithelial cells, forming a “chicken wire” or “fish net” appearance. There is no staining in the basement membrane zone (BMZ). Indirect immunofluorescence is positive in the same pattern in almost all cases indicating the presence of circulating autoantibodies.²

Pathogenesis

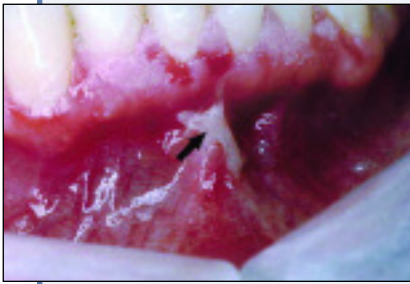
In mucous membrane pemphigus vulgaris, IgG autoantibodies against desmoglein 3 are produced and are hypothesized to hinder sterically the homophilic extracellular linkage of adjacent cells in the desmoglea of the desmosome⁶ (Fig. 2e). Consequently, cells do not adhere to each other and the epithelium falls apart. Hemidesmosomes at the basement membrane are not affected because they do not contain desmoglein 3, so basal cells remain attached to the basement membrane. In mucocutaneous pemphigus vulgaris, IgG autoantibodies to both desmoglein 1 and 3 are produced, causing lesions on both mucous membranes and skin.^{5–7} Circulating autoantibodies against desmoglein 3 or 1, or both, are usually found and the severity of disease is roughly proportional to the serum concentration. This fact allows the disease to be monitored by assessing changes in autoantibody serum concentration.

Clinical Course

Severe cases of pemphigus vulgaris affecting skin and mucous membranes are fatal if not treated. Localized lesions in the oral cavity are not life threatening but may be associated with considerable morbidity if untreated, and patients must be carefully monitored for spread of the condition to other mucous membranes and skin. Pemphigus vulgaris typically has a rapid onset, but progression is highly variable. Remission is common after an unpredictable time period, and apparent cure of the disease may be seen. About 75% of patients undergo remission after 10 years of therapy. Induction of remission depends on the initial severity of disease and response to therapy.⁷

Treatment

Corticosteroids are the primary drugs used in the treatment of pemphigus vulgaris.^{7–9} Mild localized lesions of oral mucous membrane pemphigus in patients with low titres of circulating autoantibodies may be controlled, at least temporarily, with topical corticosteroid rinses or creams, including agents such as clobetasol propionate.⁷ Intralesional triamcinolone may be used for resistant local lesions. However, patients with multifocal disease or severe localized disease require systemic corticosteroids, typically starting at 60–80 mg prednisone a day. If no con-



2a: This female patient with oral pemphigus vulgaris has typical ragged epithelial lesions of the gingiva. The arrow points to the superficial epithelial layers that have sloughed off. Blisters are rarely seen intraorally.



Figure 2b: Sloughing lesions of the soft palate are commonly seen, as in this female patient with pemphigus vulgaris.

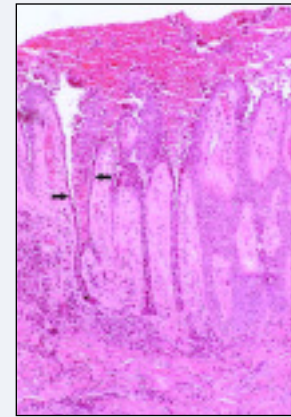


Figure 2c: Microscopically, a blister occurs within the epithelium as individual cells become detached and the epithelium separates. This lesion has lost the roof of the blister, which now contains hemorrhage, but the clinging basal layer is still present (arrow). (Hematoxylin and eosin staining, magnification $\times 100$)

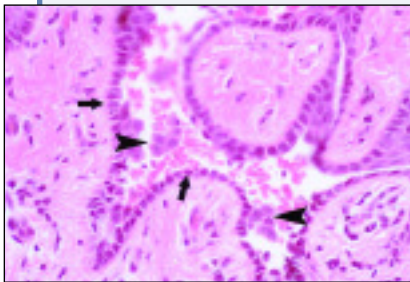


Figure 2d: Higher magnification shows the clinging basal layer (arrows) as well as detached (Tzanck) cells (curved arrows) floating in the blister space. (Hematoxylin and eosin staining, magnification $\times 500$)

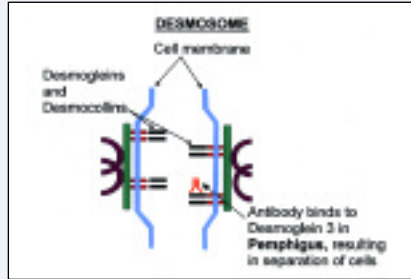


Figure 2e: Schematic diagram of the immunopathogenesis of oral pemphigus vulgaris.

trol is obtained in the first week, the dose is increased to 120 mg a day for a week, then up to 240 mg a day if necessary to prevent new blisters. Once control is achieved, the dose is reduced by half, to 120 mg a day for a week, then to 80 mg a day for a week until a level of 40 mg a day is reached. The dose is then decreased every 4 months.⁹ In most cases, low maintenance doses, usually every other day, are needed for years. High-dose pulses of corticosteroids may be delivered for relapsing or resistant cases, either orally or intravenously.⁹ Patients often become cushingoid, and deaths are now more often attributed to drug side effects than to the disease itself.⁸

Adjunctive therapy for resistant patients to reduce corticosteroid side effects includes azathioprine or cyclophosphamide or both. The dose varies depending on patient response. Other therapeutic agents now being tried include deflazacort,⁸ mycophenolate mofetyl, gold and human intravenous immunoglobulin (IVIG).^{7,9}

Paraneoplastic Pemphigus

Paraneoplastic pemphigus is a rare blistering and ulcerating disease of sudden onset of the skin and mucous membranes and always affects the oral mucosa. Oral lesions are very painful and consist of widespread, irregular shallow ulcers at multiple oral sites. Characteristically, they extend on the lip vermillion causing hemorrhagic, crusting blisters and erosions (Fig. 3a). The conjunctiva are typically severely affected with inflammation, ulceration and pain (Fig. 3b). Genital mucosa and even respiratory mucosa may be involved. Skin lesions, which may appear at any site including the palms and soles, may be blistering but often present as erythematous papular lesions resembling lichen planus.¹⁰ This condition is seen in elderly patients who usually have a malignancy, typically a lymphoma or chronic lymphocytic leukemia. Occasionally it precedes the discovery of the malignancy.

Autoantibodies are always produced against multiple antigens in the BMZ, desmogleins and intraepithelial

plaques, resulting in a severe disease with clinical, microscopic and immunofluorescence features of both pemphigus vulgaris and MMP superimposed on a lichenoid base.¹⁰ A variety of antigens have been described, including autoantibodies to desmoplakins, envoplakin, periplakin and bullous pemphigoid antigen 1 (BP230).

Paraneoplastic pemphigus indicates a poor prognosis for the patient, as its morbidity and mortality rates are high. It is treated by systemic corticosteroids, often combined with other immunosuppressive agents such as azathioprine, cyclophosphamide and methotrexate.¹⁰

Desquamative Gingivitis

Desquamative gingivitis is a non-specific clinical term that describes persistent, extensive, chronic inflammation of the attached gingival and sometimes adjacent alveolar mucosa.² MMP (part 1)¹ and pemphigus vulgaris (Fig. 2a) are 2 of the possible entities that may be included under this heading. Others include gingival involvement by such entities as lichen planus and lupus erythematosus.

Conclusion

Although MMP and pemphigus vulgaris are comparatively uncommon conditions, the dental practitioner should have a high level of awareness of these diseases to recognize and manage them, or refer patients when appropriate. Whether and at what stage to refer will depend on the practitioner's own level of comfort and experience in dealing with these patients, whether the disease is recurrent or refractory, the extent of disease (e.g., disease which has spread beyond the confines of the oral cavity is probably best referred) and the availability of a specialist. ♦



Figure 3a: Oral lesions of paraneoplastic pemphigus are ulcerative, widespread and painful. The lips typically exhibit bloody crusting ulcers as seen in this elderly male patient.



Figure 3b: Moderate to severe ocular lesions are typically seen (same patient as in Fig. 3a).

References

1. Darling M, Daly T. Blistering mucocutaneous diseases of the oral mucosa — a review: Part 1. Mucous membrane pemphigoid. *J Can Dent Assoc* 2005; 71(11):851-4.
2. Sapp JP, Eversole LR, Wysocki GP. Contemporary oral and maxillofacial pathology. 2nd ed. St. Louis: Mosby; 2004. p. 209-13, 219-21, 262-74.
3. Edwards PC, Kelsch R. Oral lichen planus: clinical presentation and management. *J Can Dent Assoc* 2002; 68(8):494-9.
4. Elder D, Elenitsas R, Jaworsky C, Johnson B Jr. Lever's histopathology of the skin. 8th ed. Philadelphia: Lippincott-Raven; 1997. p. 209-52.
5. Challacombe SJ, Setterfield J, Shirlaw P, Harman K, Scully C, Black MM. Immunodiagnosis of pemphigus and mucous membrane pemphigoid. *Acta Odontol Scand* 2001; 59(4):226-34.
6. Hashimoto T. Recent advances in the study of the pathophysiology of pemphigus. *Arch Dermatol Res* 2003; 295:S2-11. Epub 2003 Jan 9.
7. Scully C, Challacombe SJ. Pemphigus vulgaris: update on etiopathogenesis, oral manifestations, and management. *Crit Rev Oral Biol Med* 2002; 13(5):397-408.
8. Mignogna MD, Lo Muzio LL, Mignogna RE, Carbone R, Ruoppo E, Bucci E. Oral pemphigus: long term behaviour and clinical response to treatment with deflazacort in sixteen cases. *J Oral Pathol Med* 2000; 29(4):145-52.
9. Toth GC, Jonkman MF. Therapy of pemphigus. *Clin Dermatol* 2001; 19(6):761-7.
10. Allen CM, Camisa C. Paraneoplastic pemphigus: a review of the literature. *Oral Dis* 2000; 6(4):208-14.

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The authors have no declared financial interests.

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X-Linked Hypophosphatemia: Dental and Histologic Findings

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ABSTRACT

The recurrent spontaneous formation of abscesses affecting multiple noncarious primary as well as permanent teeth is the principle clinical dental feature in cases of hypophosphatemia, a condition inherited through the X chromosome. Patients often have high pulp horns, large pulp chambers and dentinal clefts. We report a case of hypophosphatemic vitamin D-resistant rickets in a patient who reported to our department on multiple occasions with spontaneous abscesses in relation to his primary teeth. The aim of this article is to review the features of this disorder and to discuss the risks and benefits of the treatment options suggested in the literature.

MeSH Key Words: abscess/physiopathology; child; dental pulp diseases; hypophosphatemia/physiopathology

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Hypophosphatemic vitamin D-resistant rickets or X-linked hypophosphatemia is associated with well documented oral and dental findings.^{1–6} Recurrent spontaneous abscess formation affecting multiple noncarious primary teeth is the principle clinical feature in these cases. Similar episodes have been reported in the permanent dentition. Dentists have diagnosed a few cases in which the systemic features were mild and dental abscesses were the first presenting sign.³ Hypophosphatemic rickets often features high pulp horns, large pulp chambers and dentinal clefts.^{5,6} It is believed that the abscesses form when pulp is infected by bacteria invading through the enamel cracks and dentinal microcleavages in the teeth.^{7,8} Usually both primary and permanent teeth have dentinal dysplasia.⁵ The teeth usually show taurodontism, poorly defined lamina dura and a hypoplastic alveolar ridge.^{8,9}

Case Report

A 3-year-old boy with X-linked vitamin D-resistant hypophosphatemia was referred to the maxillofacial and dental department at

Great Ormond Street Hospital for Children for a dental evaluation. General physical examination revealed typical bowing of the legs, marked genu valgum and rachitic rosary. Genu valgum or “knock-knee” deformity results in circumduction, a gait that requires the individual to swing each leg outward while walking to avoid striking the planted limb with the moving limb. Rachitic rosary is the name given to the bead-like enlargements of the costochondral junctions.

There was a history of rickets on the maternal side of the family (Fig. 1). The patient had a marked anterior open bite associated with the use of a pacifier. In the past, his serum calcium level was 1.1 mg/dL, phosphate level was 0.94 mg/dL and alkaline phosphatase was elevated (367 mU/mL). He had been treated with 125 mg of sodium acid phosphate and 40 mg/kg of 1,25-dihydroxy vitamin D daily. General oral hygiene instructions were given and pacifier use was discouraged.

However, between the ages of 4 and 10 years, the boy presented at regular intervals with spontaneous abscesses (Table 1). In each case, the tooth was sound, caries-free and had no

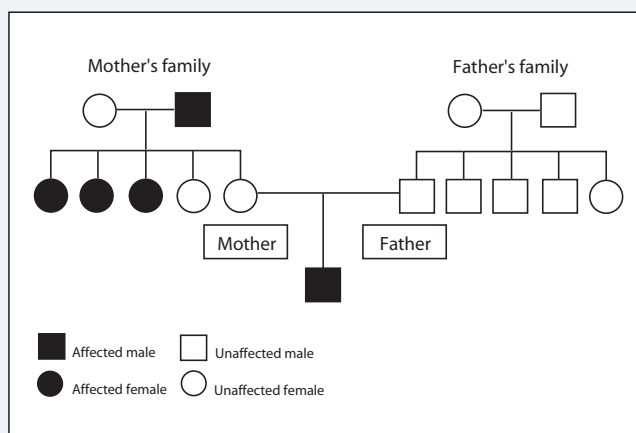


Figure 1: Pedigree chart showing the transmission of rickets from the maternal side: mother and father are phenotypically unaffected by the condition but are carriers of the affected gene.



Figure 2: Orthopantomograph shows the remaining deciduous molars with stainless steel crowns and the lower canine in the midline associated with a cystic swelling.

Table 1 Occurrence of spontaneous abscesses in the patient between the ages of 4 and 10 years

Age at time of presentation (years and months)	Tooth involved	Diagnosis at presentation
4.7	61	Acute periapical abscess
5.3	64	Chronic periapical sinus
5.4	52	Palatal abscess
6.4	71, 54	Acute periapical abscesses
7.6	74	Acute periapical abscess
7.7	53	Acute periapical abscess
8.2	84	Acute periapical abscess
9.11	63, 83	Acute periapical abscess

history of trauma. The boy often displayed submandibular lymphadenopathy associated with the abscesses. There was radiographic evidence of spontaneous root resorption in tooth 64. The teeth listed in Table 1 were extracted under local anesthetic to prevent further abscess formation. Preventive stainless steel crowns were placed on all second deciduous molars. The permanent molars presented with deep fissures warranting the placement of preventive sealants.

At the age of 11 years, the boy presented with an asymptomatic unerupted tooth 33 and a firmly retained tooth 83. On clinical examination, a hard, painless swelling and slight expansion of the labial cortical bone could be palpated in the region of tooth 41. All lower teeth were responsive to ethyl chloride and sound, and there were no changes in axial position. Radiographs confirmed that the lower left canine had transmigrated from the left side of the mandible toward the right and was closely asso-

ciated with the roots of teeth 31, 41 and 42. The canine was associated with a cyst-like lesion extending from the root of tooth 42 to the mesial aspect of the root of 34; its diameter was approximately 20 mm. The first permanent molars showed evidence of quadrangular taurodontism (Fig. 2).

As the canine was severely malpositioned, exposure and transplantation or orthodontic movement of the tooth into its correct position would have been unsuccessful. Surgical extraction of tooth 33 and enucleation of the associated cystic lesion were deemed necessary to prevent damage to the adjacent teeth from potential further expansion of the cyst. The procedure was carried out under general anesthetic. The histopathological report identified the lesion as a follicular or dentigerous cyst.

The patient is under regular review with the aim of providing orthodontic treatment for him in the future.

Discussion

Hypophosphatemic rickets is associated with defective resorption of phosphate in the proximal renal tubule and inadequate synthesis of 1,25-dihydroxy vitamin D from its precursor 25-hydroxy vitamin D.⁹⁻¹¹ Its prevalence is approximately 1 in 20 000. Of interest from the developmental perspective is the presence of taurodontism in the first and second permanent molars in many male patients (males are more severely affected by this X-chromosome linked dominant condition).^{12,13} Reports show a similar relation between this disorder and ectopically placed permanent canines. Hypophosphatemic rickets will usually manifest in 50% of the male children of a woman who is a carrier. It is inherited by a female when the disease manifests in the father and the mother is the carrier of the trait.

Histologically, teeth have enlarged pulp chambers, wide predentin, marked globular dentin and tubular dentinal defects extending from the pulp to the enamel. Enamel hypoplasia may or may not be present.^{14,15} Abe and others¹⁶ have suggested that the globular dentin caused by hypophosphatemia impairs calcification. The incompletely mineralized dentin exists in the form of calcospherites, which trap microorganisms and also impede mechanical endodontic cleaning. In addition, the thin dentin layer perforates easily and does not support restorative posts for prosthetic crowns. According to Hillmann and Geurtsen,¹⁷ the permanent teeth might also be affected and histopathologic examination of the permanent dentition is necessary. Usually the younger the patient is when the first abscess appears, the more severe the dental manifestation.¹⁴

Although odontoblast function is normal, hypophosphatemia leads to dysplastic and poorly mineralized dentin with areas of interglobular dentin. Because enamel and dentin formation occur between 4 months in utero and 11 months of age, the defects in the primary dentition can usually not be prevented. However, permanent teeth form after birth and their development could possibly be improved by medication started soon after birth. Abnormal dental development and dentin formation may persist despite therapy. The sequence of formation of abscesses usually appears to follow the sequence of eruption.^{12,17}

Some authors advocate extraction of teeth that present periradicular abscesses and eventual restoration with implants; however, endodontic and restorative treatment may not be able to maintain asepsis.^{18,19} One must conclude that the occurrence of spontaneous abscesses following a shallow cavity preparation necessitates aggressive preventive dental procedures.²⁰ In patients with this disorder, professional dental care consisting of periodic examinations, topical fluoride applications and maintenance of good oral hygiene is imperative.²¹ Moreover, the dentist as well as the pediatrician should be made aware of the features of this disorder so that early intervention can prevent subsequent serious and more invasive dental procedures. Prophylactic coverage of these teeth with stainless steel crowns on molars and composite resin on the anterior teeth should be done. This treatment should be carried out with caution and crown preparation should be minimal to avoid inadvertent pulp exposure. Another critical factor is the loss of vertical dimensions if multiple posterior primary teeth need to be extracted. Thus, there is a delicate balance between the benefits and possible risks of using stainless steel crowns. Pit and fissure sealants are useful when the teeth are erupting as they prevent ingress of bacteria into the enamel microfractures as well as initiation of caries in the deep pits and fissures.

It is evident that although permanent teeth form after birth and their development could possibly be affected by

medication started soon after birth, abnormal dental development and dentin formation may persist despite therapy. However, early diagnosis and medication may be useful in many cases. Controversy exists regarding the management of these cases with extraction of teeth at presentation of abscess, the questionable success of endodontic treatment and the possible benefits and risks associated with the use of stainless steel crowns. However, dental care of these patients should consist of periodic examinations, topical fluoride applications, pit and fissure sealants and maintenance of good oral hygiene. ♦

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References

- Berndt M, Ehrlich JH, Lazovic D, Zimmermann J, Hillmann G, Kayser C, and others. Clinical course of hypophosphatemic rickets in 23 adults. *Clin Nephrol* 1996; 45(1):33–41.
- Gallo LG, Morle SG. Spontaneous dental abscess in vitamin-D-resistant rickets: report of a case. *J Dent Child* 1979; 46(4):327–9.
- Yamazaki H, Otake Y, Tomizawa M, Noda T, Suzuki M. [A case of hypophosphatemic vitamin D-resistant rickets in which spontaneous dental abscesses were the first evidence.] *Shoni Shikagaku Zasshi* 1985; 23(1):204–14. Japanese.
- Goodman JR, Gelbier MJ, Bennett JH, Winter GB. Dental problems associated with hypophosphatemic vitamin D resistant rickets. *Int J Pediatr Dent* 1998; 8(1):19–28.
- Murayama T, Iwatsubo R, Akiyama S, Amano A, Morisaki I. Familial hypophosphatemic vitamin D-resistant rickets: dental findings and histology study of teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; 90(3):310–6.
- Seow WK. X-linked hypophosphatemic vitamin D-resistant rickets. *Aust Dent J* 1984; 29(6):371–7.
- McWhorter AG, Seale NS. Prevalence of dental abscess in a population of children with vitamin D-resistant rickets. *Pediatr Dent* 1991; 13(2):91–6.
- Yasufuku Y, Kohno N, Tsutsumi N, Ooshima T, Sobue S, Murakami Y, and other. Dental management of familial hypophosphatemic vitamin D-resistant rickets: report of case. *ASDC J Dent Child* 1983; 50(4):300–4.
- Bender IB, Naidorf IJ. Dental observations in vitamin D-resistant rickets with special reference to periapical lesions. *J Endod* 1985; 11(11):514–20.
- Breen GH. Prophylactic dental treatment for a patient with vitamin D-resistant rickets: report of a case. *ASDC J Dent Child* 1986; 53(1):38–43.
- Rakocz M, Keating J 3rd, Johnson R. Management of the primary dentition in vitamin D resistant rickets. *Oral Surg Oral Med Oral Pathol* 1982; 54(2):166–71.
- Seow WK, Latham SC. The spectrum of dental manifestations in vitamin D-resistant rickets: implications for management. *Pediatr Dent* 1986; 8(2):245–50.

13. Vasilakis GJ, Nygaard VK, DiPalma DM. Vitamin D resistant rickets. A review and case report of an adolescent boy with a history of dental problems. *J Oral Med* 1980; 35(1):19-26.
14. Seow WK, Romanink K, Sclavos S. Micromorphologic features of dentin in vitamin D-resistant rickets: correlation with clinical grading of severity. *Pediatr Dent* 1989; 11(3):203-8.
15. Seeto E, Seow WK. Scanning electron microscopic analysis of dentin in vitamin D-resistant rickets: assessment of mineralization and correlation with clinical findings. *Pediatr Dent* 1991; 13(1):43-8.
16. Abe K, Ooshima T, Lily TS, Yasufuku Y, Sobue S. Structural deformities of deciduous teeth in patients with hypophosphatemic vitamin-D resistant rickets. *Oral Surg Oral Med Oral Pathol* 1988; 65(2):191-8.
17. Hillmann G, Geurtsen W. Pathohistology of undecalcified primary teeth in vitamin D-resistant rickets: review and a report of two cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996; 82(2):218-24.
18. Pereira CM, de Andrade CR, Vargas PA, Coletta RD, de Almeida OP, Lopes MA. Dental alterations associated with X-linked hypophosphatemic rickets. *J Endod* 2004; 30(4):241-5.
19. Tulloch EN, Andrews FF. The association of dental abscesses with vitamin D resistant rickets. *Br Dent J* 1983; 154(5):136-8.
20. Herbert FL. Hereditary hypophosphatemia rickets: an important awareness for dentists. *ASDC J Dent Child* 1986; 53(3):223-6.
21. Cohen S, Becker GL. Origin, diagnosis, and treatment of the dental manifestations of vitamin D-resistant rickets: a review of the literature and report of a case. *J Am Dent Assoc* 1976; 92(1):120-9.



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Clinical Applications of Cone-Beam Computed Tomography in Dental Practice

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ABSTRACT

Cone-beam computed tomography (CBCT) systems have been designed for imaging hard tissues of the maxillofacial region. CBCT is capable of providing sub-millimetre resolution in images of high diagnostic quality, with short scanning times (10–70 seconds) and radiation dosages reportedly up to 15 times lower than those of conventional CT scans. Increasing availability of this technology provides the dental clinician with an imaging modality capable of providing a 3-dimensional representation of the maxillofacial skeleton with minimal distortion. This article provides an overview of currently available maxillofacial CBCT systems and reviews the specific application of various CBCT display modes to clinical dental practice.

MeSH Key Words: radiography, dental/instrumentation; tomography, x-ray computed/instrumentation; tomography, x-ray computed/methods

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Radiology is important in the diagnostic assessment of the dental patient and guidelines for the selection of appropriate radiographic procedures for patients suspected of having dental and maxillofacial disease are available.¹ The American Academy of Oral and Maxillofacial Radiology (AAOMR) has established “parameters of care” providing rationales for image selection for diagnosis, treatment planning and follow-up of patients with conditions affecting the oral maxillofacial region, including temporomandibular joint (TMJ) dysfunction (Parameter 2), diseases of the jaws (Parameter 3) and dental implant planning (Parameter 4).² Although combinations of plain x-ray transmission projections and panoramic radiography can be adequate in a number of clinical situations, radiographic assessment may sometimes be facilitated by multiplanar images including computed tomographs.

For most dental practitioners, the use of advanced imaging has been limited because of cost, availability and radiation dose considerations; however, the introduction of cone-beam

computed tomography (CBCT) for the maxillofacial region provides opportunities for dental practitioners to request multiplanar imaging. Most dental practitioners are familiar with the thin-slice images produced in the axial plane by conventional helical fan-beam CT. CBCT allows the creation in “real time” of images not only in the axial plane but also 2-dimensional (2D) images in the coronal, sagittal and even oblique or curved image planes — a process referred to as multiplanar reformation (MPR). In addition, CBCT data are amenable to reformation in a volume, rather than a slice, providing 3-dimensional (3D) information. The purpose of this article is to provide an overview of the unique image display capabilities of maxillofacial CBCT systems and to illustrate specific applications in clinical practice.

Types of CT Scanners

Computed tomography can be divided into 2 categories based on acquisition x-ray beam geometry; namely: fan beam and cone beam (Fig. 1).

In fan-beam scanners, an x-ray source and solid-state detector are mounted on a rotating gantry (Fig. 1a). Data are acquired using a narrow fan-shaped x-ray beam transmitted through the patient. The patient is imaged slice-by-slice, usually in the axial plane, and interpretation of the images is achieved by stacking the slices to obtain multiple 2D representations. The linear array of detector elements used in conventional helical fan-beam CT scanners is actually a multi-detector array. This configuration allows multi-detector CT (MDCT) scanners to acquire up to 64 slices simultaneously, considerably reducing the scanning time compared with single-slice systems and allowing generation of 3D images at substantially lower doses of radiation than single detector fan-beam CT arrays.³

Cone-Beam CT Technology

CBCT scanners are based on volumetric tomography, using a 2D extended digital array providing an area detector. This is combined with a 3D x-ray beam (Fig. 1b). The cone-beam technique involves a single 360° scan in which the x-ray source and a reciprocating area detector synchronously move around the patient's head, which is stabilized with a head holder. At certain degree intervals, single projection images, known as "basis" images, are acquired. These are similar to lateral cephalometric radiographic images, each slightly offset from one another. This series of basis projection images is referred to as the projection data. Software programs incorporating sophisticated algorithms including back-filtered projection are applied to these image data to generate a 3D volumetric data set, which can be used to provide primary reconstruction images in 3 orthogonal planes (axial, sagittal and coronal).

Although the CBCT principle has been in use for almost 2 decades, only recently — with the development of inexpensive x-ray tubes, high-quality detector systems and powerful personal computers — have affordable systems become commercially available. Beginning with the NewTom QR DVT 9000 (Quantitative Radiology s.r.l., Verona, Italy)⁴ introduced in April 2001, other systems include CB MercuRay (Hitachi Medical Corp., Kashiwa-shi, Chiba-ken, Japan), 3D Accuitomo – XYZ Slice View Tomograph (J. Morita Mfg Corp., Kyoto, Japan) and i-CAT (Xoran Technologies, Ann Arbor, Mich., and Imaging Sciences International, Hatfield, PA).

These units can be categorized according to their x-ray detection system.^{5,6} Most CBCT units for maxillofacial applications use an image intensifier tube (IIT)—charge-coupled device. Recently a system employing a flat panel imager (FPI) was released (i-CAT).^{7,8} The FPI consists of a cesium iodide scintillator applied to a thin film transistor made of amorphous silicon. Images produced with an IIT generally result in more noise than images from an FPI and also need to be preprocessed to reduce geometric distortions inherent in the detector configuration.^{5,6}

Advantages of CBCT

CBCT is well suited for imaging the craniofacial area. It provides clear images of highly contrasted structures and is extremely useful for evaluating bone.^{8,9} Although limitations currently exist in the use of this technology for soft-tissue imaging, efforts are being directed toward the development of techniques and software algorithms to improve signal-to-noise ratio and increase contrast.

The use of CBCT technology in clinical practice provides a number of potential advantages for maxillofacial imaging compared with conventional CT:

- **X-ray beam limitation:** Reducing the size of the irradiated area by collimation of the primary x-ray beam to the area of interest minimizes the radiation dose. Most CBCT units can be adjusted to scan small regions for specific diagnostic tasks. Others are capable of scanning the entire craniofacial complex when necessary.
- **Image accuracy:** The volumetric data set comprises a 3D block of smaller cuboid structures, known as voxels, each representing a specific degree of x-ray absorption. The size of these voxels determines the resolution of the image. In conventional CT, the voxels are anisotropic — rectangular cubes where the longest dimension of the voxel is the axial slice thickness and is determined by slice pitch, a function of gantry motion. Although CT voxel surfaces can be as small as 0.625 mm square, their depth is usually in the order of 1–2 mm. All CBCT units provide voxel resolutions that are isotropic — equal in all 3 dimensions. This produces sub-millimetre resolution (often exceeding the highest grade multi-slice CT) ranging from 0.4 mm to as low as 0.125 mm (Accuitomo).
- **Rapid scan time:** Because CBCT acquires all basis images in a single rotation, scan time is rapid (10–70 seconds) and comparable with that of medical spiral MDCT systems. Although faster scanning time usually means fewer basis images from which to reconstruct the volumetric data set, motion artifacts due to subject movement are reduced.
- **Dose reduction:** Published reports indicate that the effective dose of radiation (average range 36.9–50.3 microsievert [μSv])^{10–14} is significantly reduced by up to 98% compared with "conventional" fan-beam CT systems (average range for mandible 1,320–3,324 μSv ; average range for maxilla 1,031–1,420 μSv).^{10,11,15–17} This reduces the effective patient dose to approximately that of a film-based periapical survey of the dentition (13–100 μSv)^{18–20} or 4–15 times that of a single panoramic radiograph (2.9–11 μSv).^{14,17–20}
- **Display modes unique to maxillofacial imaging:** Access and interaction with medical CT data are not possible as workstations are required. Although such data can be "converted" and imported into proprietary programs for use on personal computers (e.g., Sim/Plant, Materialise, Leuven, Belgium), this process is expensive and requires an

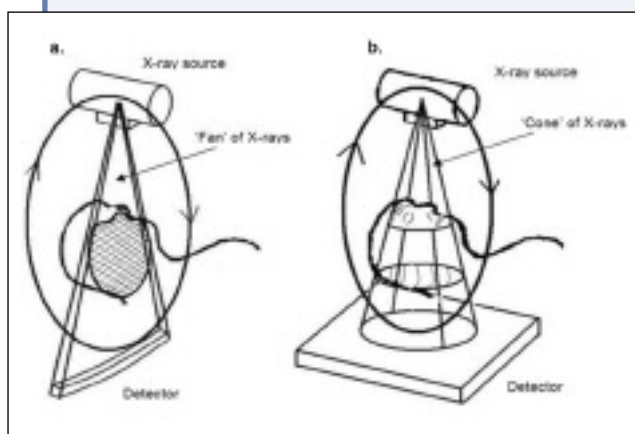


Figure 1: X-ray beam projection scheme comparing a single detector array fan-beam CT (a) and cone-beam CT (b) geometry.

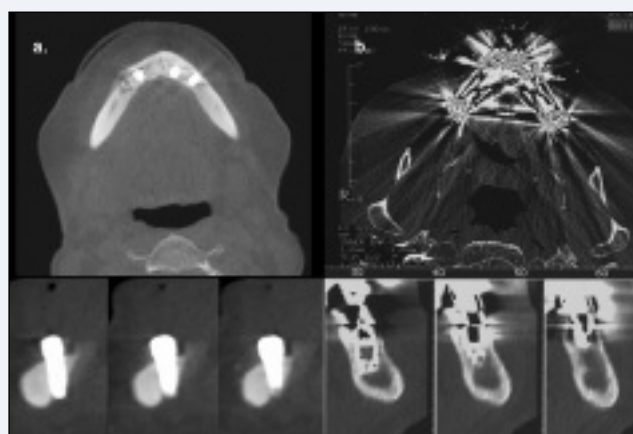


Figure 2: Relative image artifact reduction with CBCT (a) axial (top) and cross-sectional images (lower) of the mandibular arch with implants compared with conventional CT (b) axial (top) and cross-sectional (lower) images of maxillary arch with implants.

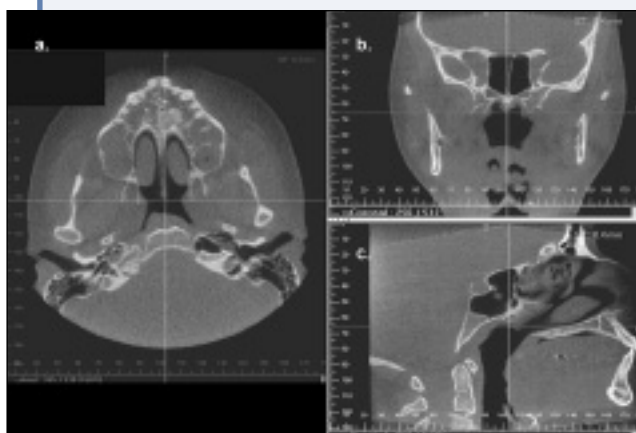


Figure 3: Representative standard CBCT monitor display (i-CAT) showing axial (a), coronal (b) and sagittal (c) thin-section slices.

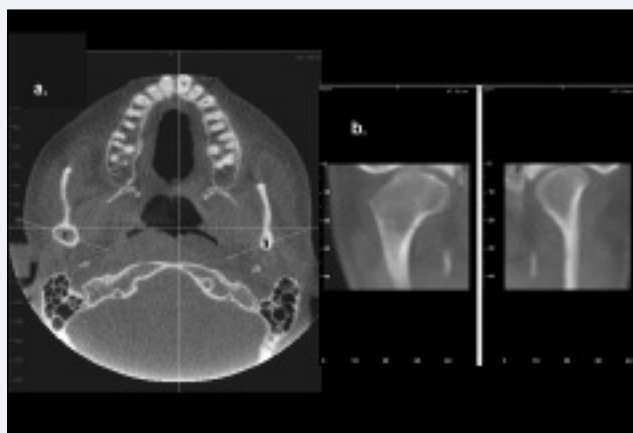


Figure 4: Bilateral linear oblique multiplanar reformation through lateral and medial poles of the mandibular condyle on the axial image (a) providing corrected coronal, limited field-of-view, thin-slice temporomandibular views (b) demonstrating right condylar hyperplasia.

intermediary stage that can extend the diagnostic phase. Reconstruction of CBCT data is performed natively by a personal computer. In addition, software can be made available to the user, not just the radiologist, either via direct purchase or innovative “per use” licence from various vendors (e.g., Imaging Sciences International). This provides the clinician with the opportunity to use chair-side image display, real-time analysis and MPR modes that are task specific. Because the CBCT volumetric data set is isotropic, the entire volume can be reoriented so that the patient’s anatomic features are realigned. In addition, cursor-driven measurement algorithms allow the clinician to do real-time dimensional assessment.

- **Reduced image artifact:** With manufacturers’ artifact suppression algorithms and increasing number of

projections, our clinical experience has shown that CBCT images can result in a low level of metal artifact, particularly in secondary reconstructions designed for viewing the teeth and jaws (Fig. 2).¹⁰

Application of CBCT Imaging to Clinical Dental Practice

Unlike conventional CT scanners, which are large and expensive to purchase and maintain, CBCT is suited for use in clinical dental practice where cost and dose considerations are important, space is often at a premium and scanning requirements are limited to the head.

All CBCT units initially provide correlated axial, coronal and sagittal perpendicular MPR images (Fig. 3). Basic enhancements include zoom or magnification and visual adjustments to narrow the range of displayed grey-scales

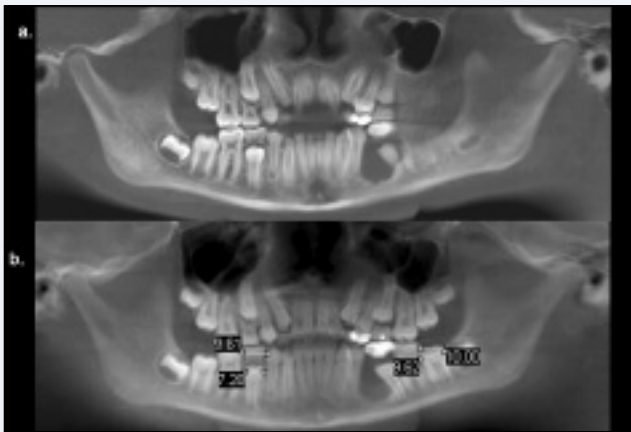


Figure 5: Narrow (5.3 mm) (a) and wide (25.6 mm) (b) slice simulated panoramic images providing anatomically accurate measurements.



Figure 7: "Ray sum" simulated lateral cephalometric projection.

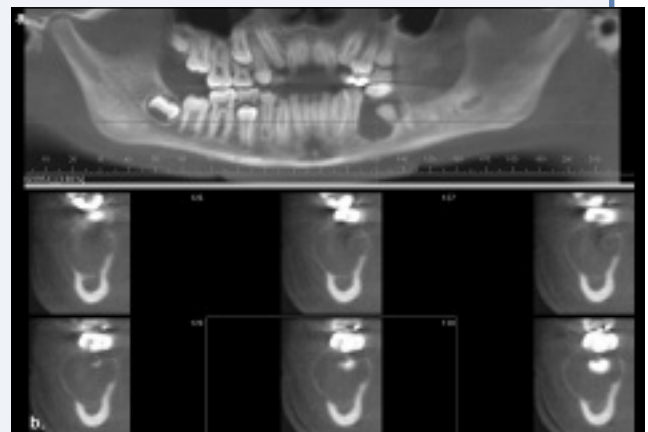


Figure 6: Reformatted panoramic image (a) providing reference for multiple narrow trans-axial thin cross-sectional slices (b) of radiolucent bony pathology in the left mandible, demonstrating bucco-lingual expansion and location of the inferior alveolar canal.



Figure 8: Right lateral maximum intensity projection (a) and shaded surface rendering of patient. (Courtesy: Arun Singh, Imaging Sciences International)

(window) and contrast level within this window, the capability to add annotation and cursor-driven measurement. The value of CBCT imaging in implant planning,^{21–23} surgical assessment of pathology, TMJ assessment^{24–26} and pre- and postoperative assessment of craniofacial fractures has been reported.^{8,9,12} In orthodontics, CBCT imaging is useful in the assessment of growth and development^{8,27–29} and such imaging is becoming commonplace in certain regions, especially on the west coast of the United States.

Perhaps the greatest practical advantage of CBCT in maxillofacial imaging is the ability it provides to interact with the data and generate images replicating those commonly used in clinical practice. All proprietary software is capable of various real-time advanced image display techniques, easily derived from the volumetric data set. These techniques and their specific clinical applications include:

- **Oblique planar reformation:** This technique creates nonaxial 2D images by transecting a set or "stack" of axial images. This mode is particularly useful for evaluating specific structures (e.g., TMJ, impacted third molars) as certain features may not be readily apparent on perpendicular MPR images (Fig. 4).
- **Curved planar reformation:** This is a type of MPR accomplished by aligning the long axis of the imaging plane with a specific anatomic structure. This mode is useful in displaying the dental arch, providing familiar panorama-like thin-slice images (Fig. 5a). Images are undistorted so that measurements and angulations made from them have minimal error.
- **Serial transplanar reformation:** This technique produces a series of stacked sequential cross-sectional images

orthogonal to the oblique or curved planar reformation. Images are usually thin slices (e.g., 1 mm thick) of known separation (e.g., 1 mm apart). Resultant images are useful in the assessment of specific morphologic features such as alveolar bone height and width for implant site assessment, the inferior alveolar canal in relation to impacted mandibular molars, condylar surface and shape in the symptomatic TMJ or evaluation of pathological conditions affecting the jaws (Fig. 6).

- **Multiplanar volume reformations:** Any multiplanar image can be “thickened” by increasing the number of adjacent voxels included in the slice. This creates an image that represents a specific volume of the patient. The simplest technique is adding the absorption values of adjacent voxels, to produce a “ray sum” image. This mode can be used to generate simulated panoramic images by increasing the slice thickness of curved planar reformatted images along the dental arch to 25–30 mm, comparable to the in-focus image layer of panoramic radiographs (Fig. 5b). Alternatively, plain projection images such as lateral cephalometric images (Fig. 7) can be created from full thickness (130–150 mm) perpendicular MPR images. In this case, such images can be exported and analyzed using third-party proprietary cephalometric software. Unlike conventional radiographs, these ray sum images are without magnification and are undistorted.

Another thickening technique is maximum intensity projection (MIP). MIP images are achieved by displaying only the highest voxel value within a particular thickness. This mode produces a “pseudo” 3D structure and is particularly useful in representing the surface morphology of the maxillofacial region (Fig. 8a). More complicated shaded surface displays and volume rendering algorithms can be applied to the entire thickness of the volumetric data set to provide 3D reconstruction and presentation of data that can be interactively enhanced (Fig. 8b).

Discussion

There is little doubt that cone-beam technology will become an important tool in dental and maxillofacial imaging over the next decade or 2. Clinical applications of CBCT are rapidly being applied to dental practice. However, although CBCT allows images to be displayed in a variety of formats, the interpretation of the volumetric data set, particularly when it comprises large areas, involves more than the generation of 3D representations or application of clinical protocols providing specific images. Interpretation demands an understanding of the spatial relations of bony anatomic elements and extended pathologic knowledge of various maxillofacial structures. Currently, any dental practitioner can purchase and operate a CBCT unit. There is mounting concern among oral and maxillofacial radiologists, based on issues of quality and patient safety, that interpretation of extended field of view diagnostic

imaging studies using CBCT should not be performed by dentists with inadequate training and experience. The AAOMR has indicated that, to use CT in implant imaging, the interpreting practitioner should either be a board-certified oral and maxillofacial radiologist or a dentist with adequate training and experience.² Perhaps, as has occurred in medical imaging where the use and costs of imaging have increased at double-digit rates, third-party payers and federal policymakers will also become involved in setting standards for providers who bill the government for obtaining and interpreting diagnostic images.³⁰ Non-radiologist dentists should not be excluded from performing CBCT imaging provided they have appropriate and documented training and experience. Given that a single CBCT scan uses ionizing radiation at levels exceeding any current dental imaging protocol series, it is timely to recommend the development of rigorous training standards in maxillofacial CBCT imaging in the interests of our patients who deserve to have imaging performed by competent clinicians.

Conclusions

The development and rapid commercialization of CBCT technology dedicated to imaging the maxillofacial region will undoubtedly increase dental practitioner access to 3D radiographic assessments in clinical dental practice. CBCT imaging provides clinicians with sub-millimetre spatial resolution images of high diagnostic quality with relatively short scanning times (10–70 seconds) and a reported radiation dose equivalent to that needed for 4 to 15 panoramic radiographs. ♦

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References

1. American Dental Association and U.S. Department of Health and Human Services. The selection of patients for dental radiographic examinations. Chicago: American Dental Association, 2004.

2. White SC, Heslop EW, Hollender LG, Mosier KM, Ruprecht A, ShROUT MK; American Academy of Oral and Maxillofacial Radiology, ad hoc Committee on Parameters of Care. Parameters of radiologic care: an official report of the American Academy of Oral and Maxillofacial Radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001; 91(5):498-511.
3. Hu H, He HD, Foley WD, Fox SH. Four multidetector-row helical CT: image quality and volume coverage speed. *Radiology* 2000; 215(1):55-62.
4. Mozzo P, Procacci C, Tacconi A, Martini PT, Andreis IA. A new volumetric CT machine for dental imaging based on the cone-beam technique: preliminary results. *Eur Radiol* 1998; 8(9):1558-64.
5. Baba R, Konno Y, Ueda K, Ikeda S. Comparison of flat-panel detector and image-intensifier detector for cone-beam CT. *Comput Med Imaging Graph* 2002; 26(3):153-8.
6. Baba R, Ueda K, Okabe M. Using a flat-panel detector in high resolution cone beam CT for dental imaging. *Dentomaxillofac Radiol* 2004; 33(5):285-90.
7. Sukovic P, Brooks S, Perez L, Clinthorne NH. DentoCAT – a novel design of a cone beam CT scanner for dentomaxillofacial imaging: introduction and preliminary results. In: Lemke HU, Vannier MW, Inamura K, Farman AG, Doi K, editors. Computer assisted radiology and surgery. Amsterdam: Elsevier Science; 2001. p. 659-64.
8. Sukovic P. Cone beam computed tomography in craniofacial imaging. *Orthod Craniofac Res* 2003; 6(Suppl 1):31-6.
9. Ziegler CM, Woertche R, Brief J, Hassfeld S. Clinical indications for digital volume tomography in oral and maxillofacial surgery. *Dentomaxillofac Radiol* 2002; 31(2):126-30.
10. Cohnen M, Kemper J, Mobes O, Pawelzik J, Modder U. Radiation dose in dental radiology. *Eur Radiol* 2002; 12(3):634-7.
11. Schulze D, Heiland M, Thurmman H, Adam G. Radiation exposure during midfacial imaging using 4- and 16-slice computed tomography, cone beam computed tomography systems and conventional radiography. *Dentomaxillofac Radiol* 2004; 33(2):83-6.
12. Heiland M, Schulze D, Rother U, Schmelzle R. Postoperative imaging of zygomaticomaxillary complex fractures using digital volume tomography. *J Oral Maxillofac Surg* 2004; 62(11):1387-91.
13. Mah JK, Danforth RA, Bumann A, Hatcher D. Radiation absorbed in maxillofacial imaging with a new dental computed tomography device. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003; 96(4):508-13.
14. Ludlow JB, Davies-Ludlow LE, Brooks SL. Dosimetry of two extraoral direct digital imaging devices: NewTom cone beam CT and Orthophos Plus DS panoramic unit. *Dentomaxillofac Radiol* 2003; 32(4):229-34.
15. Scaf G, Lurie AG, Mosier KM, Kantor ML, Ramsby GR, Freedman ML. Dosimetry and cost of imaging osseointegrated implants with film-based and computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997; 83(1):41-8.
16. Dula K, Mini R, van der Stelt PF, Lambrecht JT, Schneeberger P, Buser D. Hypothetical mortality risk associated with spiral computed tomography of the maxilla and mandible. *Eur J Oral Sci* 1996; 104(5-6):503-10.
17. Ngan DC, Kharbanda OP, Geenty JP, Darendeliler MA. Comparison of radiation levels from computed tomography and conventional dental radiographs. *Aust Orthod J* 2003; 19(2):67-75.
18. White SC. 1992 assessment of radiation risk from dental radiography. *Dentomaxillofac Radiol* 1992; 21(3):118-26.
19. Danforth RA, Clark DE. Effective dose from radiation absorbed during a panoramic examination with a new generation machine. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; 89(2):236-43.
20. Gibbs SJ. Effective dose equivalent and effective dose: comparison for common projections in oral and maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; 90(4):538-45.
21. Sato S, Arai Y, Shinoda K, Ito K. Clinical application of a new cone-beam computerized tomography system to assess multiple two-dimensional images for the preoperative treatment planning of maxillary implants: case reports. *Quintessence Int* 2004; 35(7):525-8.
22. Kobayashi K, Shimoda S, Nakagawa Y, Yamamoto A. Accuracy in measurement of distance using limited cone-beam computerized tomography. *Int J Oral Maxillofac Implants* 2004; 19(2):228-31.
23. Hatcher DC, Dial C, Mayorga C. Cone beam CT for pre-surgical assessment of implant sites. *J Calif Dent Assoc* 2003; 31(11):825-33.
24. Honda K, Matsumoto K, Kashima M, Takano Y, Kawashima S, Arai Y. Single air contrast arthrography for temporomandibular joint disorder using limited cone beam computed tomography for dental use. *Dentomaxillofac Radiol* 2004; 33(4):271-3.
25. Tsiklakis K, Syriopoulos K, Stamatakis HC. Radiographic examination of the temporomandibular joint using cone beam computed tomography. *Dentomaxillofac Radiol* 2004; 33(4):196-201.
26. Honda K, Arai Y, Kashima M, Takano Y, Sawada K, Ejima K, and other. Evaluation of the usefulness of the limited cone-beam CT (3DX) in the assessment of the thickness of the roof of the glenoid fossa of the temporomandibular joint. *Dentomaxillofac Radiol* 2004; 33(6):391-5.
27. Aboudara CA, Hatcher D, Nielsen IL, Miller A. A three-dimensional evaluation of the upper airway in adolescents. *Orthod Craniofac Res* 2003; 6(Suppl 1):173-5.
28. Baumrind S, Carlson S, Beers A, Curry S, Norris K, Boyd RL. Using three-dimensional imaging to assess treatment outcomes in orthodontics: a progress report from the University of the Pacific. *Orthod Craniofac Res* 2003; 6(Suppl 1):132-42.
29. Maki K, Inou N, Takanishi A, Miller AJ. Computer-assisted simulations in orthodontic diagnosis and the application of a new cone beam X-ray computed tomography. *Orthod Craniofac Res* 2003; 6(Suppl 1):95-101.
30. Miller ME. MedPAC recommendations on imaging services. March 17, 2005 Available from: URL: http://www.medpac.gov/publications/congressional_testimony/031705_TestimonyImaging-Hou.pdf (accessed December 2005).

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Building an RRSP Portfolio with Mutual Funds

John Webster, CFP

Mutual funds are still a popular choice for Canadian investors. In October 2005 (the most recent statistics available at press time), mutual fund net sales reached \$1 billion, propelling year-to-date sales to \$19.4 billion — the highest for that period since 2001. Total assets under management in the mutual fund industry were \$539 billion at the end of October 2005.

While it's clear that investment funds are an important part of Canadians' investment portfolios, like many investors, you may be wondering how to select the funds that are right for your investment objectives given that the 2005 RRSP contribution deadline is approaching on March 1st, 2006.

First, you'll have to decide how much investment risk you're comfortable taking. Usually, if you have a longer investment time frame you can be more aggressive in your investment decisions, since you'll have more time to recover from potential downturns in the market. When you have a shorter investment time frame, or as you get closer to the point where you want to start using your investment principal, you'll want to think about more conservative choices.

Equity funds offer the greatest potential for high returns over the long term and are considered higher risk. Bond or fixed-income funds are generally regarded as medium-risk investments and can provide long-term growth as well as an income stream. Money market funds offer low return rates but are very low risk. By building a portfolio that's balanced among the 3 categories, you'll be better prepared to ride out any market volatility.

The particular funds you select in each category will depend on factors such as your tolerance for volatility, need for income and personal investment style. For example, if you are investing for the mid- to longer term and require an equity fund with lower volatility and a steady stream of income, consider adding a dividend fund to your RRSP portfolio. (For non-registered investing, dividend income is treated very favourably for tax purposes due to the availability of the dividend tax credit. This could be even more appealing with the recent federal government announcement that taxes will be cut on dividends paid by public corporations in 2006.)

Additionally, investing in a balanced fund can provide instant diversification among cash, fixed income and equity investments. In fact, balanced funds recorded the highest sales in October 2005 with net sales of \$741 million. Total assets under management in balanced funds

were \$115 billion in October, second only to Canadian equity funds which had total assets of \$124 billion at the end of the same time period. Canadian equity funds were widely held in 2005 as Canadian equity markets outperformed throughout the year.

When comparing investment funds, check for safety features such as creditor protection. By selecting segregated funds, which are funds offered through insurance companies, you may be able to protect the money held in your RRSP from the claims of creditors in many circumstances, provided that you set up the account in good faith.

Choosing funds with low management fees and as few other charges as possible will also keep more of your money working inside your investment portfolio. For instance, an investment of \$10,000 per year over 30 years, earning an average return of 10% annually, will grow by \$200,000 more if you pay just 1 percentage point less in management fees. Other charges such as account set-up and closing charges, front- and back-end loads, and high fees for financial planning advice can also shortchange your portfolio.

The CDA RSP offers a wide range of segregated investment funds with low management fees, and the CDA Self-Directed Investment Service* provides investment funds from over 70 mutual fund companies and banks on a no-load or zero-load basis.

For no-cost assistance in selecting investment funds based on your investment time frame and financial objectives, contact a personal investment planning advisor at Professional Guide Line Inc. by calling 1-877-293-9455 or (416) 296-9455, extension 5023. ♦

Source: Investment fund sales figures obtained from the Investment Funds Institute of Canada.

*The CDA Self-Directed Investment Service is not currently available in all Canadian jurisdictions.

THE AUTHOR



John Webster is a certified financial planner and vice-president of financial planning, Professional Guide Line Inc. — A CDSPI Affiliate. In Quebec he is licensed as a financial security advisor and an advisor in group insurance and group annuity plans.



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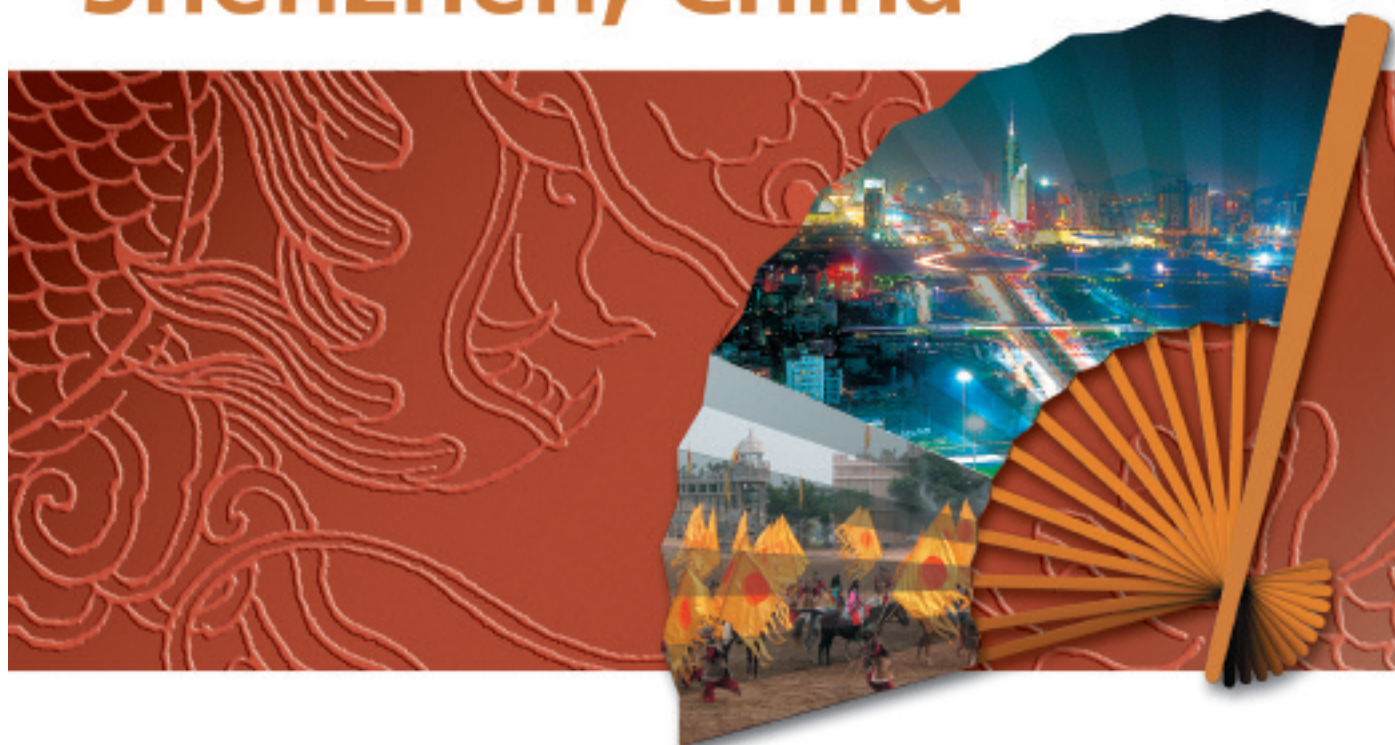


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The recently released Version 5 of the **Adstra Imaging Dental Image Management software** enables dental professionals to capture, manipulate and store images from various digital devices, intraoral or digital cameras, and flatbed scanners. A Microsoft Word Reports Module linked within Adstra Imaging enables the user to create MS Word templates and



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The "New Products" section provides readers with brief descriptions of recent innovations in dentistry. Publication of this information, which is condensed from news releases provided by manufacturers, does not imply endorsement by JCDA or the Canadian Dental Association. Please send news releases and photographs to Rachel Galipeau, coordinator of publications, at rgalipeau@cda-adc.ca. Material submitted in both English and French will be given priority.

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D1857

ALBERTA - Calgary: Practice wanted. Husband and wife team of dentists relocating to Calgary. Wish to purchase a practice in Calgary and provide compassionate care to your patients. Please call: (403) 606-3070.

D2010

ALBERTA - Lethbridge: A city of 66,000 servicing a surrounding population of about 150,000, Lethbridge is one of the fastest growing cities in Alberta. Recreation, sunshine, location and quality of life are its appeal. One of Lethbridge's premier dental offices is now for sale in the second busiest mall in the city. This vibrant office offers both exclusivity and exposure. Go to: www.drchuck.ca and www.lethbridgepages.com.

D1683

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D1842

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D1833

BRITISH COLUMBIA - Nelson:

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D1776

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D1718

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D1423

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D2008

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D2015

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D2009

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D2017

ONTARIO: Oral maxillofacial surgery. Busy full-scope practice looking for associate leading to partnership. OR time available and GA suite in office. One hour east of Toronto. If interested reply to: CDA Classified Box # 1858.

D1858

ONTARIO - Woodbridge: Opportunity to purchase an established general practice. Vendor willing to stay on as a limited part-time associate. Call (416) 821-7732 for more information. Private sale.

D1787

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D2018

Positions Available

ALBERTA - Drayton Valley: Associate required immediately. Established family practice with fun, friendly staff looking for a motivated, full-time associate to be part of our successful team. Excellent patient volume. New graduates welcome. Town has enormous growth potential, located only 1.5 hours southwest of Edmonton. Close to mountains. Excellent location. Tel: (780) 542-5395. Fax: (780) 542-3165.

D2002

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D2011

ALBERTA - Edmonton: Associate dentist required immediately for busy southwest practice to take on existing associate's patient base and new patients. Please send all inquiries via email to: hvdc@shaw.ca or by fax to: (780) 437-4471.

D2016

ALBERTA - West Edmonton: Associate required immediately for busy, progressive, well-established group office. All aspects of general

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D2020

ALBERTA - Edson: Full-time associate needed for busy, well-established family practice. Edson is centrally located between Jasper and Edmonton, and is rapidly growing. New graduates are welcome. Interested applicants please contact: Dr. Shari Jean Robinson, tel: (780) 723-3084. res: (780) 723-5221, bus. fax: (780) 723-2402, email: srobin11@telus.net.

D1843

ALBERTA - Fort McMurray: Excellent full-time associate opportunity available immediately for a motivated, energetic individual. Owner of a busy, rapidly expanding family practice in Fort McMurray, Alberta, that has an excellent team already established wants to cut back. Please call: (780) 743-3570 or fax to: (780) 790-0809.

D1817

ALBERTA - Grande Prairie: Associate, full-time needed immediately. Well-established office with six operatories. Very busy, patients waiting to see you. Contact: Susan, tel: (780) 538-2992, fax: (780) 538-0966.

D2004

ALBERTA - Slave Lake: Full-time associate required for a busy practice. Well-established office with six operatories. Excellent opportunity for new graduates or experienced dentist. Please contact: Jose Antony, Office Manager, tel: (780) 849-4477 or fax resume to: (780) 849-6332.

D1621

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D2022

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D1735

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D1844

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D1827

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D2019

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D1853

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A letter of application, accompanied by a curriculum vitae, professional credentials, a statement of teaching and research interests, and three references should be sent to:

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105 Wiggins Road, Saskatoon, Saskatchewan S7N 5E4
Tel. (306) 966-5122 • Fax (306) 966-5132
email james.stakiw@usask.ca

D2012

Applications with complete documentation will be accepted until April 30, 2006 or until a suitable candidate is found.



**Tenure Track Faculty Position in
Removable Prosthodontics
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The College of Dentistry invites applications from qualified individuals for a faculty position in Removable Prosthodontics at the Assistant/Associate Professor level depending on qualifications. The College of Dentistry is implementing an active program of curriculum renewal, faculty renewal, and research intensification. The successful candidate will be an integral part of this process. Applicants will have postgraduate training in Removable Prosthodontics at the Masters or PhD level with relevant clinical qualifications. Responsibilities will include didactic and clinical instruction of undergraduate students, research programs and administration. On site and off site private practice privileges are available. Rank and salary are commensurate with experience and qualifications. The University is committed to Employment Equity. Members of designated groups (women, Aboriginal people, people with disabilities and visible minorities) are encouraged to self-identify on their applications. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. Further information about our College and its programs are available at www.usask.ca/dentistry.

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105 Wiggins Road, Saskatoon, Saskatchewan S7N 5E4
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email james.stakiw@usask.ca

D2013

Applications with complete documentation will be accepted until April 30, 2006 or until a suitable candidate is found.

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NORTHWEST TERRITORIES - Yellowknife: And surrounding communities. Associate position. Excellent opportunity in North America's diamond capital. Good recreation and outdoor activities. Work in a modern friendly dental clinic with excellent remuneration and benefits. For more information reply to fax: (867) 873-4410. D1754

NOVA SCOTIA - Halifax: daniel daniel Dentistry is now looking for a full-time dentist. Ideal candidate must be open to adopting/already have a progressive, comprehensive and esthetic dental philosophy. Candidate may be currently associating, or have a practice they wish to transform within our practice. At least 2 years experience, as well as an existing client base is necessary. Coaching available for every step of your practice transformation. Applications are extremely confidential: daniel@danieldanieldentistry.com. D2014

NUNAVUT - Iqaluit: Associate position(s) available for immediate start. Established clinic offers generous package and full appointment book to associates. All round clinical skills are your ticket to a wide range of recreational activities! No travel required and housing available in Canada's newest and fastest growing capital city. Please apply to: Administration, PO Box 1118, Yellowknife, NT X1A 2N8, or tel: (867) 873-6940, fax: (867) 873-6941. D1497

ONTARIO - Belleville: Full-time associate required for general practice. The clinic has seven GPs, one oral surgeon and a full-service dental laboratory; current associate is moving

to the U.S. Fax resume to (613) 966-2888 or call (613) 966-2777. D2003

ONTARIO - Eastern: Bilingual experienced general dentist (2-3 years). Associateship with buy-in option. French Eastern Ontario area. Very busy clinic with 4 renovated operatories (1-2 hygienists). Reply to: CDA Classified Box # 2852. D1854

ONTARIO - Kirkland Lake/Englehart: Require full-time associate(s) in busy general practice. We have 16 operatories, four hygienists, one preventive dental assistant. Flexible hours and work schedules. Office has a proven track record for associate support. New graduates welcome to apply. Start date is negotiable. We welcome your inquiries. Tel: (705) 567-3214 or fax: (705) 567-3218. D2007

ONTARIO - Windsor: Oral & maxillofacial surgeon needed. Will consider associateship, partnership or purchase arrangement. Call Bernie Lyons: (519) 258-4563. D2006

ONTARIO - Woodbridge: A dedicated, people-oriented associate required for a growing dental practice in a high-traffic area. Three years experience preferred. Please fax resume to: (905) 851-8916. D1785

ONTARIO - Toronto: Associate, part-time, required for downtown office. Tel: (416) 922-1161, bus: (416) 233-5616, evgs fax: (416) 960-3298, email: kacinik@interlog.com. D1856

ONTARIO - 19 locations: Experienced associate required for our well-established, busy practice. Enjoy a small-town or a large city atmosphere. For more information visit our website at www.altima.ca or contact: Dr. George Christodoulou, Altima Dental Canada, tel. (416) 785-1828, ext. 201, or email: drgeorge@altima.ca. D1783

ONTARIO - Innisfil: A dedicated, people-oriented associate required for a new practice. Part time leading to full time. Three years experience

preferred. Please fax resume to: (905) 851-8916. D1786

ONTARIO/QUEBEC: Looking for bilingual associate for 5 mature and busy practices, south-west Quebec and/or Cornwall, ONTARIO - Hawkesbury Area: Full schedule (crown/bridge, endodontics, etc.). Stability, flexibility and respect assured. Possible sale. Seeing is worth believing. Contact: Luc, tel: (450) 370-7765. D1674

ONTARIO - Deseronto: Busy family practice in a small Bay of Quinte town, high gross and high insurance, requires a full-time associate. Opportunity for transition. tel: (613) 396-2974, bus: (613) 396-3762, (res.) email: meredithd@sympatico.ca. D1860

ONTARIO - Barrie: Associate needed for a family practice south end of Barrie (Ontario) 2 - 4 days/wk. Experience preferred but not required. New grads welcome to apply. For more information please respond to CDA Classified Box #2001. D2001

SASKATCHEWAN - Prince Albert: Associate position for progressive family practice. Computerized and newly renovated with six operatories, digital panorex and x-rays. Immediately assume full schedule from existing patient base. This is a great opportunity for a caring, conscientious and motivated individual. Contact: Dr. Robin Slowenko, 1403 Central Avenue, Prince Albert, SK S6V 7J4, tel: (306) 764-4144, fax: (306) 764-5430. D2021

VANCOUVER ISLAND: Associate for Comox Valley family practice. Must be interested in future purchase and transition to owner as associate. Reply: Box 1357, Comox, BC V9M 7Z9 or email: Covaldentist@shaw.ca. D2005

UNITED STATES: Outstanding opportunities across the country for new and seasoned general dentists and specialists. For details contact: Gretchen Neels tel: (800) 838-6563, ext. 209 or email: gneels@amdpi.com. D1846

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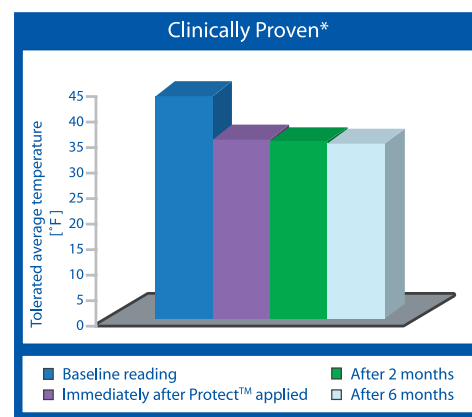
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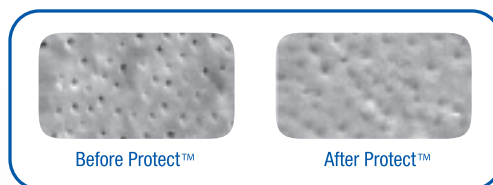
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CDA Fund Performance (for period ending December 31, 2005)

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CDA Canadian Growth Funds					
Aggressive Equity fund (Altamira)	up to 1.00%	8.1%	18.7%	10.5%	10.0%
Common Stock fund (Altamira)	up to 0.99%	20.2%	17.4%	3.7%	8.3%
Canadian Equity fund (Trimark) ^{†1}	up to 1.50%	8.4%	13.0%	6.3%	9.0%
Dividend fund (PH&N) ^{†2}	up to 1.20%	13.7%	17.7%	10.1%	17.7%
Income Trusts fund (Sceptre)	up to 1.45%	19.7%	25.6%	n/a	n/a
Special Equity fund (KBSH) ^{†3}	up to 1.45%	18.6%	19.2%	-0.6%	14.8%
TSX Composite Index fund (BGI) ^{††}	up to 0.67%	23.1%	20.8%	6.0%	10.3%
CDA International Growth Funds					
Emerging Markets fund (Brandes)	up to 1.77%	28.8%	21.1%	9.8%	3.1%
European fund (Trimark)	up to 1.45%	7.1%	0.7%	-11.3%	3.3%
International Equity fund (CC&L)	up to 1.30%	3.4%	2.9%	-8.7%	2.1%
Pacific Basin fund (CI)	up to 1.77%	15.7%	7.7%	-8.5%	-0.1%
US Small Cap fund (Trimark)	up to 1.25%	1.2%	-0.8%	-9.5%	n/a
Global fund (Trimark) ^{†4}	up to 1.50%	4.7%	5.8%	4.2%	8.7%
Global Stock fund (Templeton) ^{†5}	up to 1.77%	4.5%	8.1%	-0.6%	n/a
S&P 500 Index fund (BGI) ^{††}	up to 0.67%	1.2%	2.2%	-3.7%	6.7%
CDA Income Funds					
Bond and Mortgage fund (Fiera)	up to 0.99%	1.6%	3.9%	5.1%	5.6%
Fixed Income fund (McLean Budden) ^{†6}	up to 0.97%	5.2%	5.7%	6.3%	7.0%
CDA Cash and Equivalent Fund					
Money Market fund (Fiera)	up to 0.67%	2.0%	2.0%	2.4%	3.3%
CDA Growth and Income Funds					
Balanced fund (PH&N) ^{†7}	up to 1.20%	8.6%	8.1%	1.6%	6.9%
Balanced Value fund (McLean Budden) ^{†8}	up to 0.95%	9.2%	9.7%	6.1%	9.1%

CDA figures indicate annual compound rate of return. All fees have been deducted. As a result, performance results may differ from those published by the fund managers. CDA figures are historical rates based on past performance and are not necessarily indicative of future performance. The annual MERs (Management Expense Ratios) depend on the value of the assets in the given funds. MERs shown are maximum.

[†] Returns shown are those for the following funds in which CDA funds invest: ¹Trimark Canadian Fund, ²PH&N Dividend Income Fund, ³KBSH Special Equity Fund, ⁴Trimark Fund, ⁵Templeton Global Stock Trust Fund, ⁶McLean Budden Fixed Income Fund, ⁷PH&N Balanced Pension Trust Fund, ⁸McLean Budden Balanced Value Fund.

^{††} Returns shown are the total returns for the index tracked by these funds.

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